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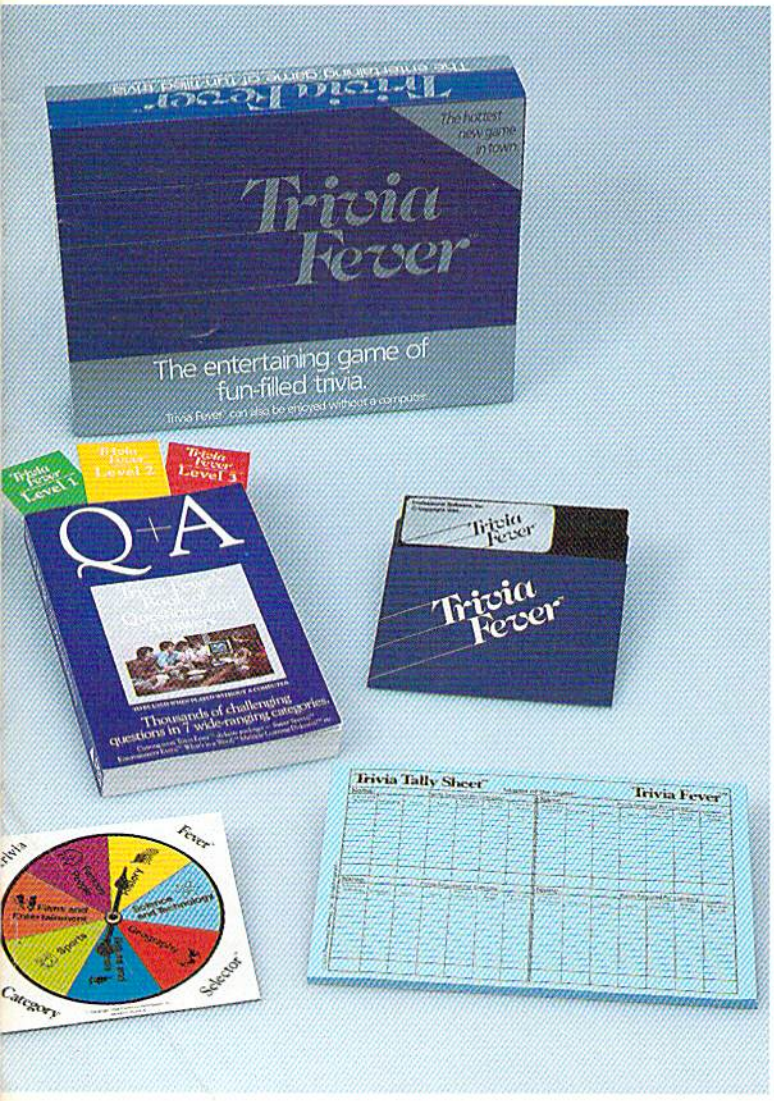

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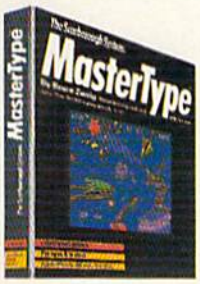

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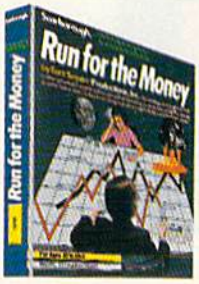

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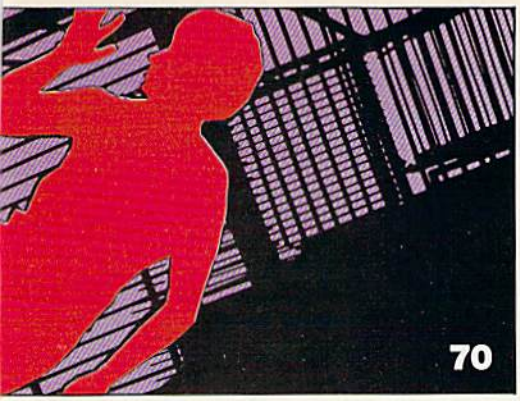

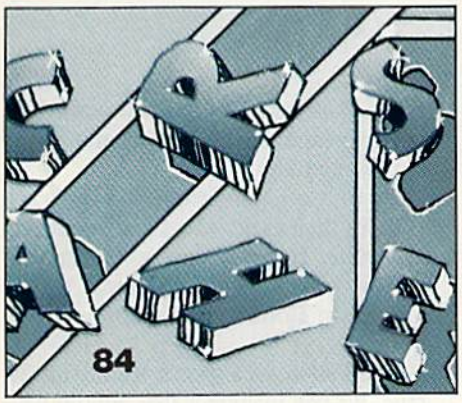

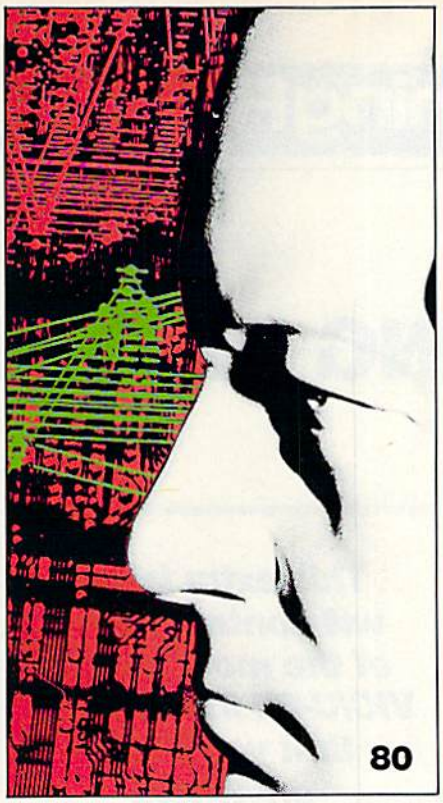

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Cover illustration by Anna Davidian.

Designed by Suzanne Torsheya.

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SOMETHING EXTRA SPECIAL

In response to a call from our readers for more information about Commodore computing, *RUN* announces an extra issue of the magazine to be released just after the new year. Entitled "The Home User Guide to Commodore Computing," this extra issue promises to be a handy reference guide, containing information of lasting value that readers will refer to again and again. This issue is not included in the 12-issue subscription price, but we feel that it's a value all of our readers should take advantage of. (Look for the ad annoucing this extra issue in next month's *RUN*.)

The editors of *RUN* have assembled, in one issue, some of the most valuable and useful information for VIC-20 and C-64 users that you'll find anywhere.

First, let's take the Magic column. For many of our readers, this is their favorite section of the magazine. In this special issue, columnist Lou Sander will brew up over 500 entries—those published in January through December, plus 150 more valuable and useful hints and tips for both beginning and experienced Commodore owners. These tricks will be compiled and indexed according to subject, for easy reference.

This extra issue will contain some of the most useful VIC/C-64 information that you'll find anywhere

If that's not enough, consider the half-dozen introductory articles to help the Commodore owner get started in Basic programming, assembly language, graphics, sound and music and telecommunications.

Another section will contain a glossary of Commodore-related computing terms. This section will define acronyms and expressions and give examples of commonly used terms.

For those Commodorists who want to share their experiences and questions with other computer users, this special issue will also feature a complete, up-to-date list of Commodore clubs and user groups.

In addition, as a special feature of this issue, we will include a free pullout wall poster containing handy reference material that makes programming the C-64 and VIC-20 easier. This reference chart will feature Basic commands, error messages, convenient Peeks and Pokes, ASCII codes, op codes and special graphics characters—all the programming information you must constantly seek out in manuals—in one visually attractive chart.

The editors of *RUN* wanted to offer something special for our readers—something that they could hold onto and refer to throughout the year. We think we've found it in this special issue. We think you'll agree. **db**

How to type listings from *RUN*

Typing in listings can be difficult enough without having to worry about strange graphics characters, charts or tables. That's why we decided to make it easy to enter listings from *RUN* by translating everything we thought might be confusing in any program.

When you see something between the curly brackets, all you have to do is press the keys indicated. For example:

{SHIFT L}—means hold down the shift key and press the L key at the same time.

{COMD J}—means hold down the Commodore key (it is on the lower left side of the keyboard) and press the J key at the same time.

{SHIFT CLR}—hold down the shift key and press the CLR/HOME key.

{HOME}—press the CLR/HOME key without shifting.

{CTRL 6}—hold down the control key and press the 6 key.

{FUNCT 2}—function 2 (in this case, you hold down the shift key and press the function 1 key).

{CRSR UP} {CRSR DN} {CRSR LF} {CRSR RT}—these are the four cursor directions.

{UP ARROW}—means the arrow key (the one with the pi sign under it).

{LB.}—the British pound sign (£).

{PI}—the pi sign key (π); (shift and press the up arrow key).

In some instances, when a large number of characters or spaces are repeated in a listing, we will represent them this way: {22 spaces} or {17 CRSR LFs}.

Print vs Print#

RUN readers should be aware of difficulties that may arise when entering listings that contain the PRINT and PRINT# commands.

These two commands may look very similar, but they are different. If, for example, you use a question mark (?) to abbreviate PRINT in a line such as 10 PRINT#4,A$, then you are signaling to the Commodore computer that you are trying to print the variable #4, which is not a legal variable name.

The command PRINT#4 actually means "print to device number 4." You can abbreviate PRINT# by hitting the P key and the shift and R keys at the same time and then entering the device number. But *do not* abbreviate PRINT# with a question mark.

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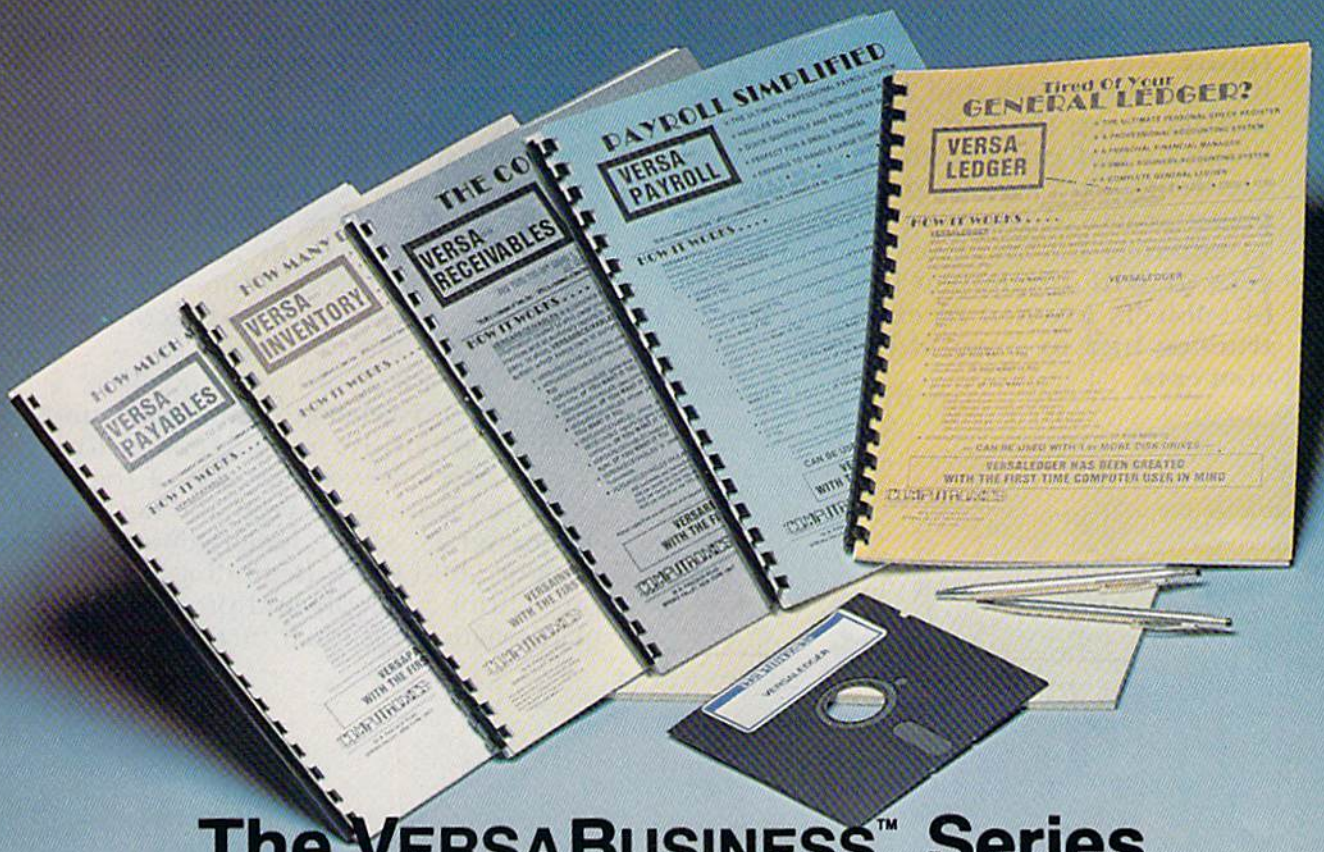

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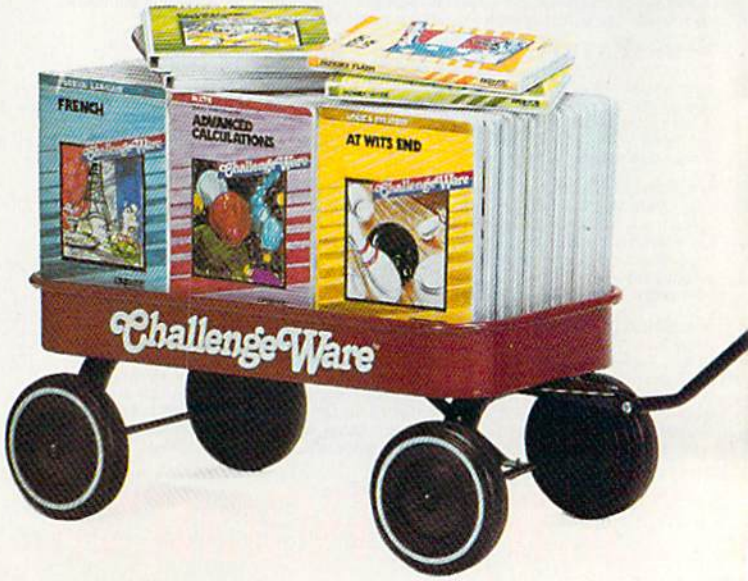

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Magic

Compiled by Louis F. Sander

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Every month, MAGIC brings you brief and useful computer tricks from around the world—tricks that others have found to make computing easier, more enjoyable or more exciting.

MAGIC features simple hardware ideas, one-line programs, useful programming techniques, little-known computer facts and similar items of interest. We look for new or recycled material that is of current value to Commodore computerists and that can be implemented with a minimum of time, effort, or theoretical knowledge.

Send your own tricks and requests for a Trick writer's guide to:

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RUN *will pay up to $50 for each original trick we print.*

MAGIC's tricks are numbered in hex, the number system of sorcery and computers.

With Halloween on the horizon, many minds are mulling matters Magical. Along those lines, we commanded the Coven's computer to analyze our bag of tricks, to see if *RUN*'s Magic is basically white or black. With legerdemainiac logic, with prestidigitous precision and with just a bit of *soul*, the Keeper of the Keywords has come to a conclusion: This column, its proprietor and all its fine contributors are dealing in black and white Magic. Elementary, my dear Gutenberg.

This month's featured subject is video displays—a dozen tricks to make yours clearer and more colorful. To round things out, we pulled the strongest and most mystical tricks from our bag, and added the most unusual ones we could find.

So put that skeleton back in the closet, throw that pumpkin into the cauldron and meditate upon The Book. In other words, drop what you're doing and observe October's awesome offerings.

$ED Easy hexing—If you can't handle hexadecimal in your head, here's something that will move you in that direction. Just memorize the fact that $1000 hex = 4096 decimal. Then use that information as a shortcut when using the SYS command to access hex locations.

For example, to access a program at $9000 hex, just type SYS 9 * 4096. To access one at $9008, just type SYS 9 * 4096 + 8. If you go one step further and memorize the hex digits for decimals 10–15, it will be easy to use the SYS command to call $C000 (where there's a 4K block of protected RAM), by typing SYS 12 * 4096. That's a lot easier than trying to memorize 49152. (or is it 49512?—I *never* can remember for sure.)

For more complex SYS calls, remember that $100 hex = 256 decimal, and $10 hex = 16 decimal. Then $CF83 easily becomes 12 * 4096 + 16 * 256 + 8 * 16 + 3.

Eric Haver
Squirrel Hill, PA

$EE Word trick—Here is a program to tutor computer users in Pig Latin. It translates English to Swine, and after very little practice, most students should have little trouble with Ig-pay Atin-lay. Study hard, because a second language always looks impressive on a job application!

```
10 PRINT "{SHFT CLR}"
20 A$="SWHAT" : PRINT
30 INPUT "ENGLISH";A$
40 B$=RIGHT$(A$,LEN(A$)-1) : A$="-"+LEFT$(A$,1)+"AY"
50 PRINT : PRINT"{2 spaces}SWINE:" ;B$;A$
60 GOTO 20
```

Gary Forney
Oelwein, IA

$EF C-64 lockup bug—The C-64 has an editing bug that causes you to lose control of the keyboard at certain times. The bug crops up when you exceed two screen lines while entering text at the bottom of the screen. If you attempt to delete back to the second line, horrible things happen, and they are hard but not impossible to correct.

First your keyboard locks up. Then, if there's a program in memory, the computer attempts to run it. If it ends up on an Input statement, you're in big trouble, since you can make no input. If there is no program in memory, the computer may attempt to load one from tape.

Many solutions to this bug have been advanced, but they don't seem to work consistently. Here are some that we've tried:

- Use one of the following cursor colors when typing, and the bug won't occur: black, white, purple, green, orange, brown, gray 2 or light green.
- Press the shift and 3 keys, which might get a Press Play on Tape message. If it does, press your recorder's play key, then hit the run/stop key.
- Plug a joystick into port 1 and work it actively, pressing and releasing the fire button all the while. This might also get the Press Play message.
- Use your reset button, then use an Un-New program to resurrect whatever you had in memory.

Robert L. Lykins
Anchorage, AK

$F0 Solomon's Basic—Problem: three kids, one computer, all want to use it. Solution:

```
10 PRINT "WAIT WHILE I CHOOSE"
20 FOR I=1 TO 5000 : NEXT
30 INT(X=3*RND(0)+1)
40 IF X=1 THEN PRINT "ALICIA IS FIRST" : END
50 IF X=2 THEN PRINT "KEN IS FIRST" : END
60 IF X=3 THEN PRINT "SARAH IS FIRST" : END
```

Nick Long
Carey, OH

$F1 Overseas computing—Many computerists who contemplate foreign travel become needlessly concerned about the 220-volt current and their 110-volt computers. In West Germany and Italy, it is easy to purchase a 300-watt, 220-110V stepdown transformer for about $25. For many years I have run computers and associated equipment from such a transformer, and have had no problems. My transformer currently handles a VIC, 1541 disk, MPS-801 printer and a Panasonic portable TV, again with no difficulties.

If you bring a U.S. TV overseas and use it only with your computer, you will have no trouble, providing you use a stepdown transformer. Trying to use it for TV reception will give a picture but no sound. Most European TVs will work with a U.S. VIC, but will not reproduce sound. The same is true for U.S. TVs used with European VICs.

William J. Dirks
Somewhere in Germany

$F2 Easyscript trickery—The documentation doesn't mention that Easyscript supports joystick panning in both Edit and Output to Video modes. During Edit mode, the joystick gives full wraparound—left, right, up and down, with good speed. In the Output to Video mode, there is smooth scrolling left, with right wraparound. The fire button advances the text line by line, and can be held down for rapid motion. It all makes reading the output a sit-back-and-relax situation.

Some joysticks may induce a crash, but can be plugged in after the program has loaded. I use a track ball in port #2, without any problems at all.

Colin Johanson
Niddrie, Australia

$F3 Video vitalizer—The display on a conventional TV set can be greatly enhanced by tying a 1000-ohm potentiometer across pins 1 (luminance) and 4 (video out) of the 64's audio/video plug, then adjusting it for best color and resolution. Radio Shack's DIN plug #274-003 and any wire-lead 1000-ohm trim pot help keep this job neat. (Be careful about the pin numbers. In the DIN system, pins 1 and 4 are next to one another. Ed.)

James G. Cooper
New Albany, IN

$F4 TV connectors—Many TV sets now on the market have 75-ohm F-type connections on the back of the set. Some don't even have the old standard 300-ohm connections! Rather than use the switch box provided with the computer, use an RCA female to F male adapter, available at most electronics stores. (Radio Shack #278-255.)

Not only will your connection at the back of the set be more elegant, but your picture reception may improve (mine did, dramatically), since you've maintained the same impedance and eliminated the switch box, which may add interference to your modulated signal.

Even if you have only 300-ohm connectors, try using an RCA to F adapter with a 75-ohm to 300-ohm matching transformer, also available at most electronics stores. Your picture quality may improve!

Mike Phebus
Lafayette, IN

$F5 TV interference tip—The wavy lines that run through your picture can sometimes be eliminated by unplugging the power cord from your TV and plugging it in the other way (unless the plug is keyed, but in that case you probably wouldn't have the wavy lines).

Ed Badger
Merrimack, NH

$F6 Video interference—You can reduce screen interference by coiling the cord that runs from the computer to the TV or monitor. When you get it the way you want it, tie the coil with string or plastic tie wraps. (Changing the cable length also can be of help. Ed.)

Jerome Beck
Glendora, CA

$F7 TV tricks—Are you still having trouble with the wavy lines on your TV screen? Try disconnecting the TV antenna terminals from the TV/computer switch on the back of your TV. Better yet, do not use the switch at all. Just disconnect the TV antenna and hook the computer directly to the TV's 75-ohm antenna input connector. If your TV does not have a 75-ohm input on it, use a Radio Shack 75-300-ohm transformer (part #15-1140).

Another trick is to install a Drake TV-75-HP high pass filter between the computer and the TV or to install a Drake LF-2 or LF-6 ac line filter on the computer and/or TV.

Walt Grosch
Milwaukee, WI

$F8 Money-saving TVI tip—I have a Commodore 64, a 1541 disk drive and a Gemini 10X printer with a Cardco interface. I use a standard TV for a monitor and have been plagued with interference. The interference is the greatest when the disk drive or printer is energized.

I intended to buy a 1701 monitor to solve my interference problems when I discovered an antenna interference filter sold by Radio Shack. I installed this filter (part #15-581 or 15-580) between the TV antenna terminals and lead from the TV/computer switch.

The interference was eliminated, and presentation quality now approaches that of a monitor.

Clifford J. Manspeaker
Warner Robins, GA

$F9 Ultimate TVI control—For years I had been plagued with the heartbreak of television interference. I tried moving things around, changing plugs, putting foil around the RF modulator and switch—all to no avail. What *was* I to do? Then the idea of sealing my video system with a good coax line hit me, and it works!

My local Radio Shack precut a cable to the length I needed, put the proper connectors on both ends and sold me the necessary adapters to make everything fit together. I took it home and tried it, and presto!—no more lines or noises.

Bill Haines
Warsaw, IN

$FA Test patterns—Here is a short program that provides an acceptable substitute for a color bar/dot generator. It is written for the C-64 but is easily converted to the VIC-20.

```
10 PRINT CHR$ (147);:POKE 53280,0:POKE 53281,0:FOR I = 1 TO 24
20 PRINT"{CTRL 9}{CTRL 3}{7 spaces}{CTRL 7}{7 spaces}
   {CTRL 8}{7 spaces}{CTRL 6}{7 spaces}{CTRL 2}{7 spaces}
   {CTRL0}":NEXT
30 GOSUB 200
40 FOR I = 1 TO 24:PRINT"{40 periods}";:NEXT
50 GOSUB 200
60 FOR I = 1 TO 24:PRINT"{40 SHFT + }";:NEXT
70 GOSUB 200
80 GOTO 10
200 GET A$:IF A$ = "" THEN 200
210 PRINT CHR$(147);:RETURN
```

To change screens, hit any key. For the VIC-20, change line 10 to read:

```
10 PRINT CHR$(147);:POKE36879,8:FOR I = 1 TO 22
```

Instead of seven spaces in line 20, use four spaces. Change lines 40 and 60 to read 22 instead of 40 in the Print statement.

Terrill S. Barkley
Columbus, NE

(continued on p. 120)

TWO SURE WAYS TO GET MORE OUT OF YOUR COMMODORE 64

I AM THE C-64 provides you with a friendly and patient private tutor. This series is the perfect guide to learning all the power your Commodore 64 has to offer.

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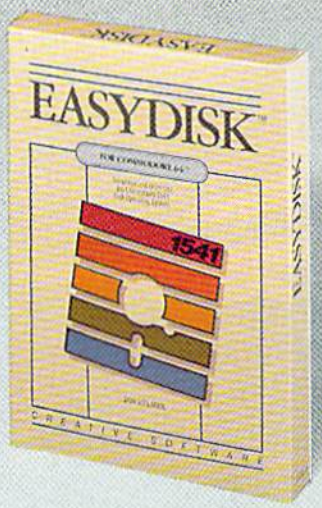

C R E A T I V E S O F T W A R E

230 East Caribbean Drive, Sunnyvale, CA 94089

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Software Gallery

Compiled by Shawn Laflamme

Summer Games

If You're an Aspiring Olympian, Here's Your Chance To Go for the Gold!

Olympic music fills the air, the torchbearer ignites the eternal flame and doves of peace are released into the air above the stadium. The Olympic games are about to begin.

This is the opening ceremony of Summer Games, a new release from Epyx. This is a highly advanced disk program allowing one or two players to compete in eight Olympic events. The game offers its contestants very realistic graphics, a wide variety of sounds and music and a fluid motion that simulates gravity to perfection.

You begin Summer Games by typing in your name and selecting the country that you wish to represent. There are 18 countries from which to choose, including the tiny Principality of Epyx. The nationality that you choose in the game is very important—at the end of each event, all scores are displayed, your flag is shown and your national anthem is played.

The main menu of Summer Games has six options including: competing in one event or all of them; practicing an event; the number of joysticks to be used; a view of the world records and a repeat of the incredible opening ceremony. The world-records screen is very impressive. The names of the record holders are immediately recorded here, and Olympic music adds a touch of elegance to the screen.

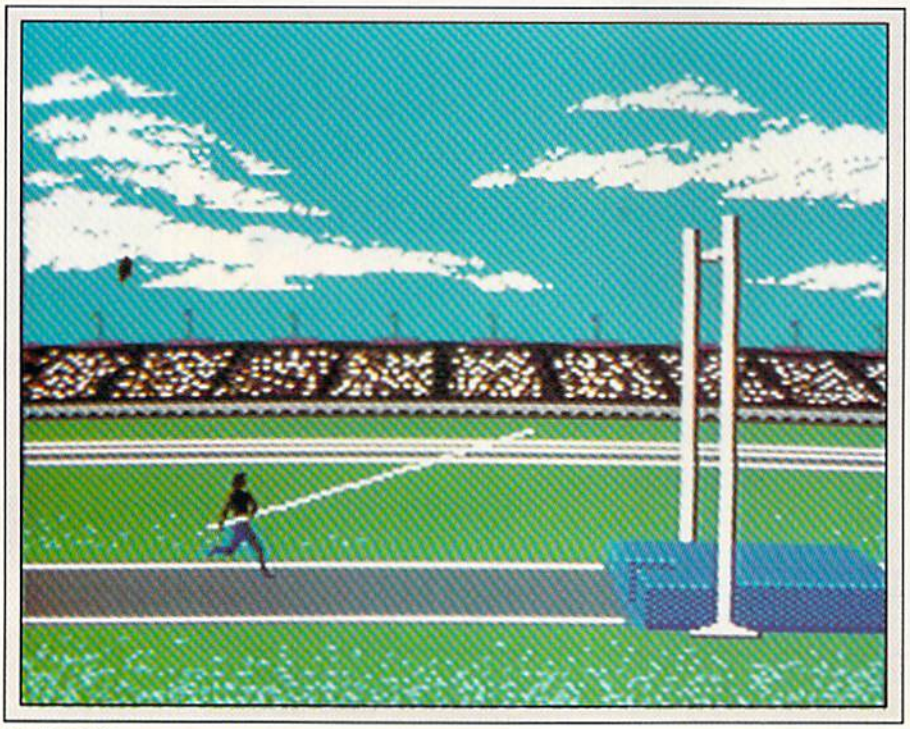
Let's examine each of the eight events in Summer Games.

Pole Vaulting

To prepare for this event, you must first select your bar height. (The bar height is initially set at 4 meters.) Three different pole grips are offered to the vaulter, but I have had the best luck with the high grip, because it will give you the most height.

Once the pole grip is selected, you begin your run by pushing the fire button. As your vaulter runs, try to judge when the pole will fit into the vault box, and then pull down to lower your pole. To master this event, try several practice runs. When your pole fits into the vault box, notice how far your vaulter is from the edge of the screen. If you can remember this distance, you have discovered an easy method to determine when to lower your pole.

Once the pole is planted in the vault box, push your joystick forward to propel your vaulter up and over the bar. By pressing the fire button one more time, the vaulter releases the pole and falls



Report Card

Superb!
An exceptional program that outshines all others.

Very Good.
One of the better programs available in its category. A worthy addition to your software library.

Good.
Lives up to its billing. No hassles, headaches or disappointments here.

Mediocre.
There are some problems with this program. There are better on the market.

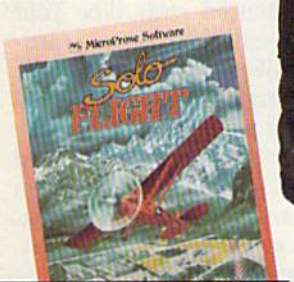
Poor.
Substandard, with many problems. Should be deep-sixed!

GREAT BEFORE, NOW EVEN BETTER!!

Improved with new options, additional instruments, new navigation aids, and more!!

SOLO FLIGHT SIMULATOR

REAL LIFE CHALLENGES FOR THE AIR FORCE MAJOR — GREAT FUN AND LEARNING — FOR HIS 10 YEAR OLD SON!!!



Commodore 64 Screen Picture

Major Bill has over 3000 hours of flying. He loves the sophistication of the SOLO FLIGHT simulation and its real life challenges of deteriorating weather, failing instruments, and overheating engines!! He knows the reality of flight — with SOLO FLIGHT he can bring it home!!

Bill Jr. has no real flying hours, but just moments after he plugs in his joystick, he's airborne, experiencing the fun and learning of flight. He loves the great 3-D graphics, the takeoffs, the touch and go's, and the NEW "INSTRUCTOR PILOT" option which enables the computer to give him flight instruction just like his fighter pilot Dad would!! Bill Jr. loves the fun of flying — with SOLO FLIGHT he has it!!

SOLO FLIGHT is a real flight simulator that includes VOR's, ILS, 21 different airports, VFR, and IFR flying. SOLO FLIGHT is easy to get started with, but you will get hooked on its Fun and Excitement!! Try to master all the challenges of SOLO FLIGHT. But be careful, because that may take many more flying hours than a Major has!!

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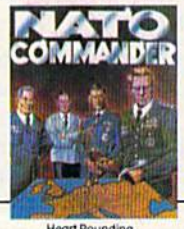

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The graphics of the Gymnastics event are excellent, depicting overhead lights, mats in the background and a scoreboard.

safely to the mat below.

This event is an excellent challenge, requiring you to coordinate your joystick movements. This is one of the most difficult events to master in Summer Games.

Platform Diving

You begin this event with your diver on the end of the diving board, 30 feet above the pool. Press the fire button to set your diver in motion.

Once your diver has left the board, move the joystick forward, backward, left or right to determine the type of dive you wish to do. Remember that each position of the joystick not only determines the type of dive, but also the rate of your diver's body rotation. Become familiar with each diving position and its rate of body rotation, because every dive must be completed with your diver's body entering the pool vertically and fully extended. This is done by pushing the joystick forward after the diving maneuver is completed.

Each contestant must complete four dives, evaluated by seven computer judges. Bear in mind that the difficulty of each dive also determines a multiplier, which can amount to many extra points for your diver. A perfect dive is awarded a 10.0, and your difficulty multiplier can go as high as 4.1.

I'm very pleased with the poolside graphics of this event, and the sounds of divers hitting the water correctly and incorrectly is very distinguishable. Platform Diving isn't as difficult as Pole Vaulting, but it offers a different type of challenge.

4 × 400-Meter Relay

To start the relay, press the fire button, and your runner will be placed at the starting line. Watch the countdown; when the starting gun is fired, move the joystick to the right to begin running. Be very careful not to run before the gun is fired, since it will constitute a false start. Two false starts will disqualify you from this event.

You'll have to pace your runners, because each runner has a different amount of stamina. Pacing a runner is accomplished by centering the joystick for normal running and pushing it to the left for coasting. If you continue holding the joystick to the right, the runner will run at top speed, and lose his energy.

To judge how much you should pace your runner, observe the other runner and watch your energy gauge at the bottom of the screen. When the bar is long and white, you have plenty of energy, but as the bar disappears, so does your stamina.

The baton is passed by pressing the fire button, but timing is critical. If you miss your handoff, the action on the screen will freeze momentarily, and you'll lose precious seconds in the race.

This event looks good, plays well and has many interesting special effects. I particularly enjoy the way the screen scrolls with the runner from the beginning of the relay to the finish line.

100-Meter Dash

The 100-Meter Dash begins exactly like the 4 × 400-Meter Relay. By moving the joystick to the right, you begin the dash for the gold. The difference between this event and the relay is that you must run by moving your joystick back and forth or up and down as fast as you can. The graphics and sounds of the 100-Meter Dash are identical to those of the relay, but the dash is played differently, and it offers a greater challenge if you run against computer competition.

Gymnastics

Gymnastics takes the Olympics indoors to a world of new challenges and surroundings. To start this segment of Summer Games, press the fire button, and your gymnast will raise her hands. When you release the fire button, she begins her run.

Press the fire button again at the right moment, and she will jump onto the springboard and leap toward the horse. This is a tricky moment in the event, because you must move your joystick to the right or left to obtain a 180-degree axial body twist. This maneuver increases the difficulty rating of your performance and gives you a better chance to obtain a high score.

Press the fire button one more time to push off the horse, and her body is again in the air. Pull back on your joystick to finish the vault, and try to correct any landing problems by moving the stick in the opposite direction that your gymnast is leaning. This event is evaluated by one computer judge, and the winner is determined by the combined score of two vaults.

Gymnastics is the most complicated event in Summer Games, and it's the most challenging. The graphics of this event are excellent, depicting every detail including overhead lights, mats in the background and an interesting scoreboard. The sounds of Gymnastics are kept simple, but they complement the action. The entire procedure described above must be done in mere seconds, with perfect accuracy.

Freestyle Relay

It's time to put on your bathing suit and prepare for the Freestyle Relay in the Olympic pool. Press the fire button to start the countdown, and pull the joystick to the right to make your swimmer jump into the water. (You're allowed two false starts.)

Once you're in the water, you must press the fire button each time your swimmer's arm enters the water, creating a power stroke. As you swim to the center of the section marked with red floats (located at the opposite end of the pool), pull your joystick to the left, and your swimmer will get the maximum kick turn. Four swimmers must complete two laps of the pool each to complete the Freestyle Relay.

Freestyle Relay is another masterpiece of excellent graphics and sounds. The graphics are again very detailed, displaying the lanes in the pool, floating red markers at the far end of the pool and wonderfully animated swimmers. The screen scrolls to the right during the swimmer's first lap and back to the left for the return lap.

This event is easy to play, but jumping into the pool and the kick turn require some practice.

F-15 STRIKE EAGLE

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F-15 STRIKE EAGLE is available for Commodore 64, ATARI (48K), and Apple II (64K) computers. Suggested retail price is only $34.95. Find STRIKE EAGLE at your local retailer, or call or write for MC/VISA, or COD orders. Add $2.50 for Postage and Handling (Int'l add $4.00USD). MD residents add 5% sales tax.

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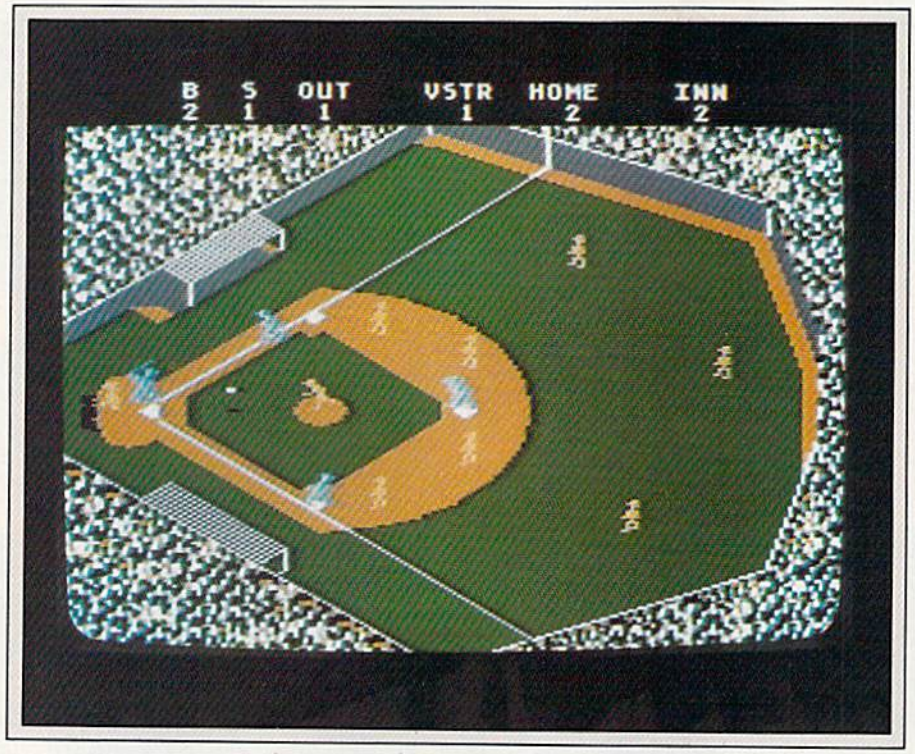

100-Meter Freestyle

The 100-Meter Freestyle is played identically to the Freestyle Relay, except you have only one swimmer who must complete two laps of the pool. The graphics and sounds are the same, and the dive into the water and the kick turn are accomplished in the same manner.

This event provides an excellent trainer for the Freestyle Relay.

Skeet Shooting

Skeet Shooting is the final event of Summer Games, and it's by far the most artistic. This event is just like the real thing, offering the player two trap houses, located at opposite sides of the screen. One or two targets are launched into the air at one time. By pushing the fire button, targets are released from the trap houses, with one shot being given for a single target and two shots for two targets. You must move the joystick to aim your gunsight, and then press the fire button to shoot at the target. There are eight stations in Skeet Shooting, with 25 targets per round.

The graphics of Skeet Shooting are superb, with beautiful mountains in the background, accenting the pastoral setting. The graphics programmer of this event really outdid himself! The trap houses are well designed, and the eight shooting stations even cast shadows. The targets cast moving shadows as they enter the air, and they disintegrate when they are shot.

Gravity is your worst enemy in this event, so don't leave your gunsight in one position very long, or it will be slowly pulled down. Following a target with a constant motion gives you a truer shot.

Overall Effect

The overall effect that Summer Games had on me was one of surprise. First of all, Epyx assigned practically every in-house C-64 programmer to this project. My second surprise was the fact that Epyx approached this project not in a cartoon sense, but in a realistic manner. The graphics take on an appearance of Olympic poster art.

I would like to recommend Summer Games to every Commodore 64 games player who is willing to accept the challenge. It's the only Olympic contest in America featuring the Russian team! *(Epyx, Inc., 1043 Kiel Court, Sunnyvale, CA 94089.)*

John Jermaine
Taylorville, IL

Star League Baseball

Bring the Excitement Of the Old Ball Game To Your C-64

Bottom of the eighth, runners on first and third, no outs. The relief pitcher, "Knuckles" Flanagan, looks to the catcher for the sign as the batter steps up to the plate. While Knuckles may not have the power of "Heat" Muldoon or the sinker of "Curves" Cassidy, he didn't get his name for the size of his hands. He winds up and throws a slow sinker, but it gets away from him—ball one. The catcher tosses it back to the mound. Knuckles looks for the sign while the runner on first takes a big lead. Knuckles winds up, and this time he throws a knuckle ball. The batter swings and misses. Strike one.

Again the runners take their leads, only this time Knuckles spins and throws the ball to the third baseman and catches the man off the bag. The runner heads for home, but the catcher is waiting there when the third baseman tosses the ball over the runner's head. He turns around to try to get back to third, but gets caught in the rundown.

One out, man on first. The count—one and one. The next pitch is high and inside. Two and one. Another knuckle ball, but this time the batter fights it off into the stands. Two and two. One more strike will put him away. Knuckles winds and throws a changeup, but the batter is waiting for it. It's a sharp line drive straight at the shortstop. The ball takes a nasty bounce off the infield turf and the runner on first takes off for second. The shortstop manages to hold on to the ball, and he spins and throws to second for the force. The second baseman snags the ball cleanly, wheels and fires it to first trying for the double play. The throw and the runner reach first at the same time. It's going to be a close call!

Star League Baseball from Gamestar is one of those games that you find

yourself cursing at four in the morning when you know that you have to be up the next day at seven. It is one of the most frustratingly simple, yet seemingly impossible computer games that you will ever love.

When you first start playing Star League Baseball, you will think that it is awkward on defense and impossible on offense. The technique for throwing from any position to any base is hard to get used to, but eventually, when you turn that first double play, it won't seem so difficult.

Pitching is something that will require reading the instructions once or twice (at least), but once you've mastered it, you have more than enough options to develop a definite style with each of the three possible pitchers. One of the many nice features of Star League Baseball is the option allowing you to bring in a relief pitcher during the seventh-inning stretch if your starting pitcher begins to tire.

Batting is about as easy as actually facing a big league pitcher. It takes a lot of practice just to get to the point where you can foul off one out of four pitches. Don't be surprised when you strike out the first dozen times against the computer. If you decide to jump right into a game against the computer, you may soon find that there is a good reason why Gamestar included the batting practice option, allowing you to take as much time as you like.

Once you do get on base, it is possible to steal a base or two (especially if you are playing a human opponent), but don't take too big a lead or you might get picked off.

Star League Baseball has numerous options, including: two player or solitaire games; a choice of three pitchers, each having different pitching styles; relief pitching; a Batting Practice mode; Liners and Sluggers modes where the former hit for average and the latter go for the fence.

The game is also embellished with stadium organ music (including a nerve-wracking "pressure" tune when the bases are loaded, which is guaranteed to make you edgy), realistic graphics, crowd noises and even an electronic scoreboard that flashes advertising and scores around the league between the innings.

The best thing about Star League Baseball is that you will not be able to master it in one sitting, or even two or three. Like real baseball, it is easy in principle, but it takes a great deal of practice to become good at it. The subtleties of play and the wide variety of options make this a game that you will want to play over and over again. *(Gamestar, Inc., 1302 State St., Santa Barbara, CA 93101. $31.95.)*

Guy Wright
***RUN* staff**

OmniWriter & OmniSpell

Here's a Full-Featured Word Processor with a Built-in Spelling Checker

If you've been looking for a word processing program for your Commodore 64, you already know there are many to choose from. But the selection isn't easy.

Prices vary widely, and features differ between products. Some are bundled with spelling checkers as an added bonus. One such program is OmniWriter & OmniSpell, from Human Engineered Software.

OmniWriter & OmniSpell is a full-featured word processor and spelling checker, packaged in an attractive plastic storage case. It comes with a detailed 75-page manual. OmniWriter's features include move, delete, insert blocks of text, center text, align columns of numbers, create headers and footers, automatic page numbering, global search and replace, adjustable screen colors and complete printer support.

After loading OmniWriter, there is room for about 17 pages of text (34,000 characters). Longer text can be chained together for editing and printing. Text is easily centered with the press of one key. And what you see on your TV or monitor will be in almost the same format on the printed copy.

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For serious word-processing tasks, OmniWriter & OmniSpell is hard to beat.

Regular and numerical tabs can be set, and OmniWriter uses a format line to help you control text entry. A true word-wrap feature is included. Any word that cannot fit within the right margin is automatically moved in total to the start of the next line. This makes screen editing and proofreading easy.

Both OmniWriter and OmniSpell are menu-driven programs, allowing you to move to different parts of the programs with easy-to-follow steps. So, if you get lost or don't understand how to enter a certain command, you can recover easily without losing any of your text. OmniSpell is included in the package (no extra charge), and features a 30,000-word English dictionary.

Printer support is very complete with both device #2 (IEEE user port) and device #4 (serial port) usable depending upon your printer and interface requirements.

Now that you have an idea of the basic features of OmniWriter & OmniSpell, let's take a closer look at some of their strong and weak points and whether or not you should consider buying this package.

Strong Points

OmniWriter has many strong features to note. One of the most important is horizontal scrolling. As you enter text, for example, on an 80-column letter, the screen will move as you go beyond the normal 40-character viewing limit. In other words, it acts like a window moving across your document, letting you view different sections as they will actually be printed.

Other strong features include: the ability to select different color combinations for background, character and border display; regular and numerical tabs; true word wrap; headers and footers and a Work Page feature. The Work Page is a separate area you can use to store help information, reference text or items to be merged into form letters.

OmniWriter has another feature that very few C-64 word processors have. This is the capability to merge a disk directory into your document and then print it. Other programs allow you to view a disk directory, but few allow you to make a hardcopy at the same time.

OmniSpell also has several strong features. Besides performing the basic spelling checks you'd expect, OmniSpell also gives you statistics about your document. For example, you can get a listing of the number of words, unique words, sentences, paragraphs and pages. Also, you can set up several user dictionaries, containing words you often use (such as professional terminology) that are not in the main program dictionary.

Both programs make good use of the Commodore's function keys. For instance, F1 is used to page forward in your document, while F7 turns the Insert mode on and off. A function key overlay card is included, listing the command for each function key.

OmniWriter is relatively easy to learn once you understand the different commands and formatting symbols. You can also perform disk operation tasks without having to leave OmniWriter and then reload it later. For example, you need to have formatted disks ready when you want to store your text. If you forgot to format some disks, OmniWriter allows you to do this within the program.

The documentation is very complete and easy to follow, since it's written in tutorial style. Sample documents are included with the program to aid learning, and the manual contains sections covering error messages and system prompts, which will help you recover from mistakes. Finally, OmniSpell is on the same side of the disk as OmniWriter. This means you do not have to insert or turn over a disk to do a spelling check.

Weak Points

As for weak points, there are a few worth noting. First, your keyboard will not have repeating keys unless you put in a command (POKE 650,128) before loading OmniWriter. Second, you cannot print a copy of the text in the Work Page section. This severely limits the usefulness of this feature.

Next, if you generate relatively large documents, memory limits may make the use of OmniSpell cumbersome. To get around this, you'll have to split your document into two or more pieces before running a spelling check. As for speed, a large document may take four to five minutes to check, due to the speed limitations of the Commodore 1541 disk drive (not due to OmniSpell).

Finally, the manual, while complete and well written, has no index and lacks enough illustrations to really show how many of the features work. If you have used other C-64 word processors, then this shouldn't bother you. But if this is your first encounter with word processing software, you may find some of the sections hard to follow until you actually practice them several times (and make several mistakes).

A Good Value

OmniWriter & OmniSpell is a very complete package with many strong points. The weak points noted are common to many programs and should not keep you from considering this package. Since this is a full-featured word processor, it can be used for business applications as well as home use. Younger users who understand basic word processing commands will also be able to make good use of OmniWriter & OmniSpell.

Overall, this package is a very good value. While $69.95 may seem high when compared to other word processors, the combination of many good features along with a very good spelling checker makes OmniWriter & OmniSpell well worth considering.

I highly recommend OmniWriter & OmniSpell as a complete word processing package. It may be more than you need if you write only occasional letters, but for serious word processing tasks, it's hard to beat. *(Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005. $69.95.)*

Larry Bihlmeyer
Pontiac, MI

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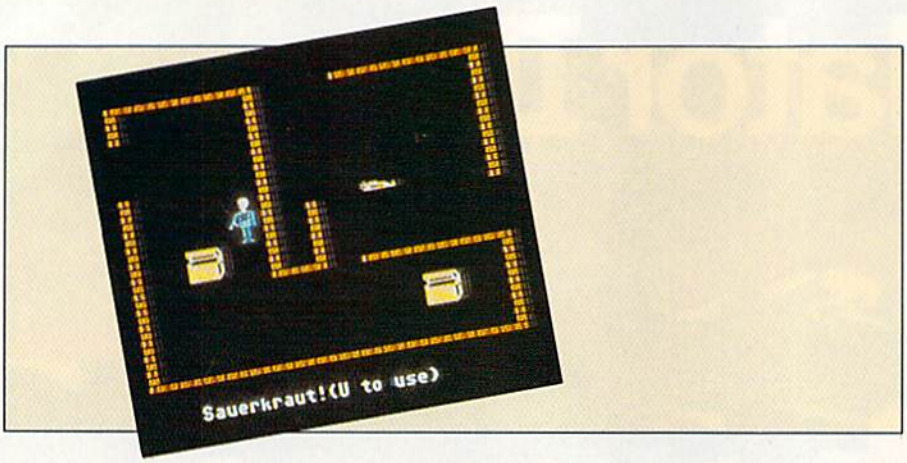

Castle Wolfenstein

Find the Nazi War Plans And Make Your Escape From This Ancient Fortress

A

World War II saw some dark and desperate hours where the efforts of a single individual could mean the difference between miraculous victory and crushing defeat. Courtesy of Muse Software, C-64 gamers can add their endeavors to the valorous contributions of other wartime heroes with Castle Wolfenstein.

You must assume the role of a captured GI, incarcerated in the newly established Nazi headquarters at Castle Wolfenstein. The Fuehrer's minions will do anything to learn your vital military secrets. A tortured cellmate gives you a fully loaded (ten rounds) M-98 pistol and the knowledge that the Nazi war plans, known as Operation Rheingold, are somewhere in the ancient fortress.

As an army private, escaping with the plans is of paramount importance to you. Turning them over to the Allied High Command will not only shorten the war and save lives, but it will also earn you a well-deserved promotion.

With each corresponding increase in rank from corporal, sergeant and lieutenant, to captain, colonel and general, the castle becomes more difficult to get out of alive. For added incentive, a mystery rank is bestowed upon the extremely capable.

Keyboard or joystick control is possible, though the Joystick mode still requires keyboard input to handle such functions as firing the gun (left arrow key), hurling a grenade (Q) and providing an inventory (return). Other examples include use of the run/stop key to save a game in progress, pressing the U key to use the contents of an open chest and pressing the space bar to unlock chests and doors, or to search guards, depending upon the specific situation.

It's often best to beat a hasty retreat from a newly-entered room if the gun isn't angled correctly to meet the latest threat. A precision joystick really comes in handy here.

Projected in an overhead panorama, the labyrinth of Castle Wolfenstein scrolls to present new rooms when you're on the lam. Doorways, stairs, SS guards, chests and doors are depicted. The graphics and use of color are adequate; the gameplay is absolutely engrossing!

One big difference between this and other games is the hardware-free voice synthesis. Not only will your C-64 speak, it will do so with true Teutonic flavor. Achtung!, Kaputt, Kamerad and Schweinhund are a few examples. Though not as clear as the synthesis of Muse's Space Taxi, the guttural German is nevertheless intelligible.

My cellmate was right, I've got to get out of here quick! I'll grab a uniform, snatch the plans, and I'll be a hero. Maybe I'll even get a medal from Ike!

I'm just glad those SS guards aren't around now. That last one wouldn't leave me alone. I had to use my last grenade to finish him off. It's a good thing his bulletproof vest fits me. I'll probably need it.

Better duck back around the corner—that room is full of them. What's this? A chest. Hmmm, looks like it'll take too long to open. A well placed shot should do the trick; I hope to God it's not full of explosives!

Now that I've rested, eaten the sauerkraut and had some wine, I'd better get a move on. "Achtung! Halt!" Oh no, time to waste another guard. Whew! That was too close.

Luck must be with me; the Nazi war plans are in this chest. Now all that's left is to get back to my regiment in one piece. Strange, I made it through the past four rooms without a hitch.

I spoke too soon! Here comes real trouble just when I'm fresh out of bullets, and there's no time to lob a potato masher, either. "Halt! Folgen!"

They've got me and the plans. They can't hold me for long though. I'll try and try again until I break out of here!

You'll keep trying too—Castle Wolfenstein is a winner. But those crack SS troops are tough to beat. Be prepared! *(Muse Software, 347 N. Charles St., Baltimore, MD 21201. $29.95.)*

Ted Salamone
Bridgeport, CT

Typing Tutor III

Learn the Fundamentals Of Touch Typing On Your C-64

C

Typing Tutor III is well-designed for teaching the keyboard and developing good touch-typing habits. The program is less useful for gaining speed and proficiency after you have learned the keys. Its companion game, Letter

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And there is nothing new to learn for the *FLASH!* No special tricks or techniques. Once it's in, just watch it go.

But if you're really serious about programming, the *1541 FLASH!* is a gold mine. The manual will show you how to write software allowing data transfer to and from the 1541 disk drive at speeds up to *10 times* the normal.

For programs that usually load with a " '*',8,1" command, just hit Shift/Run-Stop. A spreadsheet program like BUSICALC 3 then loads in about 25 seconds.

The *1541 FLASH!* even adds 21 extra commands for the Commodore 64 user. Some of these include editing, programming and loading commands, as well as "DOS Wedge" commands. You can ignore all these commands, though, and just enjoy the rapid disk operations.

It wowed the crowd at the Computer Olympics. Once you see its sheer speed, you'll know why. Call its coach, Skyles Electric Works, to place your order or to get more info.

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Invaders, is suitable for typing drill, but has little graphic appeal and does not allow the player to choose his skill level.

Typing Tutor III's strongest training feature is its emphasis on the home keys. You begin with the home keys on the left hand and gradually learn those for the right hand. Thereafter, every new key is introduced in conjunction with the corresponding home key. Even Letter Invaders groups letters and characters with their home keys, providing considerable reinforcement for using the right fingers to strike the keys.

You can choose from several menu options. The recommended place to begin is with the alphabet-key lessons. Other options include lessons for learning the number keys and tests for words, numbers and the whole keyboard. You can change parameters such as turning sound on or off, setting a time-response parameter and choosing the number of text lines in tests. Another option, called Introduction, gives instructions for using the program.

Each lesson shows a keyboard, highlighting the keys to be covered in the lesson. In copying the practice characters, your errors are noted with both an audible beep and a red arrow. When you complete a lesson, the screen moves to a progress report, which includes raw speed, accuracy, corrected speed and a list of the letters you missed. The computer also measures your response time on individual letters and shows you which letters you typed above your goal speed.

From the progress report, you can return to the main menu, see graphs showing your speed and accuracy on individual letters or quit the program. You can also try a test on the letters you have just learned or create new lessons that emphasize particular keys. When you tire of the lesson, the back arrow key takes you to the progress report.

As you move through the lessons, you are introduced to numbers, punctuation and the special characters on the top row of keys. Apparently, the program designer assumed that you would know which characters require a shift key. While the tests use shifted characters, only the Standard Typing Test uses both upper- and lowercase letters. This test, consisting of text, is the only one that requires you to do a normal typing task, and its usefulness is limited because the same text is used every time.

Typing Tutor III is a practical tool for learning the keyboard. The program gives you constant measureable reports on your progress. It is not exciting or a lot of fun, but it probably gives a more solid typing foundation than programs that consist primarily of games. Because it creates lessons around the keys on which you are weakest, it promotes an even skill.

Letter Invaders adds a nice variety to

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the Typing Tutor III package. However, as a game, it is as mundane as the public domain games it resembles. The invading letters are extra-large and in color. That is the extent of the graphics. You cannot set speed or skill level.

I expect the game could be frustrating for novice typists. I was hard-pressed to keep up, and the program consistently tested me at 63 words per minute. When the letters destroy the defending base, you move to a screen full of statistics. You find out how many letters came down, how many shots you fired and how many you hit. Your score is adjusted depending upon your accuracy. You have the option of starting a new game, which begins with home key letters, or continuing into more difficult letters. As a drill, it is mildly entertaining. As entertainment, it is rather mediocre.

The disk comes sealed in an envelope bound in a handsome, spiral-bound book. While the book is attractive, it gives very little information that is not already in the program. I would like more explanation of the speed and accuracy graphs. More information guiding you to the most effective use of the progress reports would also be welcome. The package should also show how the Commodore 64 keyboard differs from a standard typewriter keyboard.

Typing Tutor III is a solid educational program, as long as it is not expected to teach typing skills beyond elementary keyboard knowledge. In all fairness, I doubt that any computer program is good for increasing speed and typing proficiency. When you speed drill on a line of text, one skipped letter can make the computer think that the whole line is wrong because the correct letters are not in the right position.

If, however, your goal is to learn the keyboard and develop good typing habits, then this program is an excellent choice. *(Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020. $49.95.)*

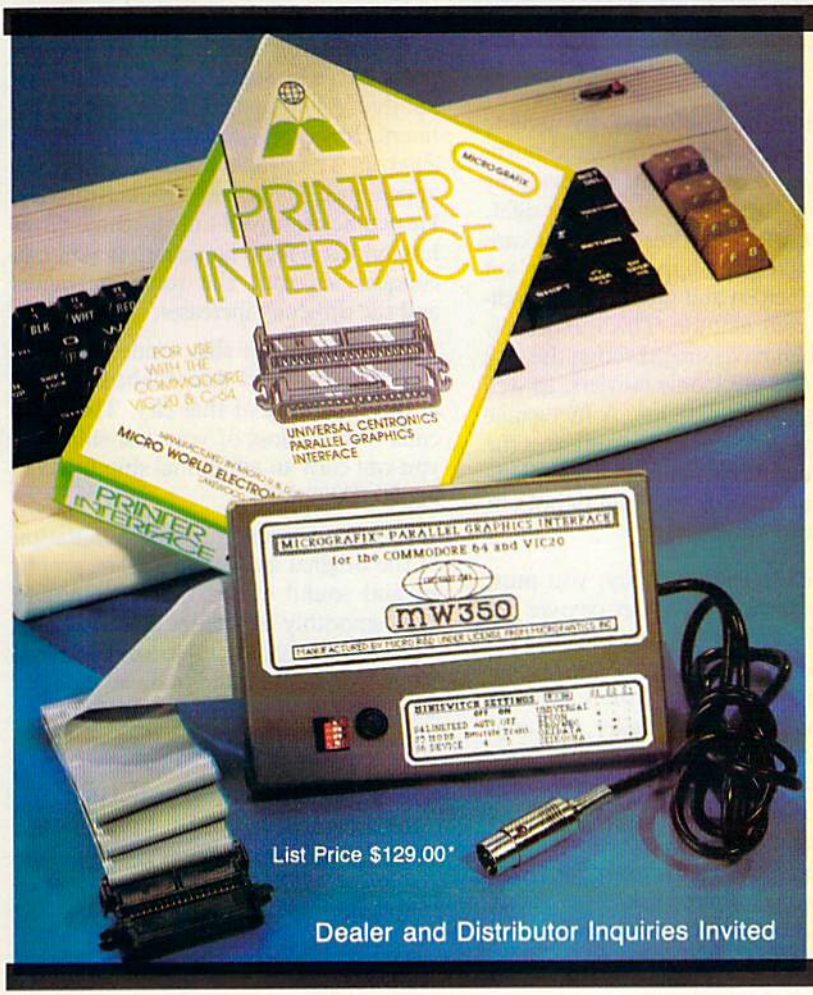
Annette Hinshaw
Tulsa, OK

Zaxxon

An Evil Robot Awaits You In the C-64 Version of This Arcade Favorite

B

Almost everyone is familiar with Zaxxon, one of the more popular arcade games during the past year.



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Well, the Synapse version of Zaxxon for the Commodore 64 is an official, fully licensed copy of Sega's original game. It was created by Peter Adams, who also worked on Synapse's highly successful Blue Max game for the C-64.

For those who never visit the local arcades, Zaxxon is a classic space encounter, putting you at the controls of an attack shuttle spacecraft. You must strafe the enemy Asteroid City in an attempt to destroy fuel tanks, gun emplacements, missiles and enemy aircraft. With the aid of an altimeter you must barnstorm your way through narrow wall openings, lethal electronic barriers and deadly rocket fire.

After a successful run across the Asteroid City, you will find yourself in the middle of a deep space dogfight with squadrons of enemy planes. Surviving the perils of outer space brings you to another, more difficult Asteroid City and a showdown with the evil robot, Zaxxon. Successfully destroying Zaxxon allows further play, but with increased difficulty. The game continues until all of your ships have crashed or been destroyed by enemy fire.

Your ship is controlled by pulling back on the joystick to climb and pushing forward to dive. Turns are made by moving the joystick to the left or right, while the fire button fires your laser cannon. An altimeter appears on the left side of the screen and gives a rough indication of your altitude. This is especially helpful when navigating through the wall openings and electronic barriers, as well as in deep space dogfights. A fuel gauge at the bottom of the screen indicates the fuel remaining, which can be replenished by destroying the fuel depots in the Asteroid Cities.

In the early levels of play, you must fly over the walls and under or over the deadly electronic barriers erected to protect the Asteroid City. As play progresses, the walls become more difficult to penetrate, leaving smaller openings to pass through. These openings are also protected by electronic barriers, so your task is doubly difficult. The easiest way to gauge your position in relation to the openings is to fire your laser cannon and watch where it hits.

At the beginning of your mission, you enter the first Asteroid City. You must successfully make your way through the city and destroy as many enemy aircraft as possible. The higher your tally here, the fewer aircraft you will encounter in deep space. You should also try to destroy the fuel depots to increase your own fuel supply and score points. You can also earn points for each radar tower, gun emplacement and base missile you destroy while negotiating the perils of the Asteroid City.

After leaving the city, you enter deep space and encounter the enemy aircraft that survived your earlier onslaught, along with enemy tracking satellites. The size of each aircraft helps indicate its relative altitude, with smaller planes being lower than larger planes. The differences are only slight, so it's mostly luck when you can match another craft's altitude and destroy it with laser fire. The screen displays the remaining number of enemy planes throughout the game. If you can destroy all the enemy planes, you'll score a bonus of 1000 points.

If successful, your flight through the perils of deep space brings you to yet another Asteroid City. This one is different, however, since it's the fortress of Zaxxon. The deadly robot will make his appearance, launching seeker-missiles. He can be destroyed only by three direct hits on his missile launcher. If you can conquer Zaxxon, the round advances and the difficulty increases.

If you lose your ship inside an Asteroid City, your next ship will be launched at the beginning of that city. The game ends with the loss of your last ship, but you can earn an additional ship by scoring 20,000 points.

This is an excellent C-64 adaptation of the original arcade game. The graphics and sound effects are outstanding! The smoothly scrolling graphics produce a very realistic three-dimensional effect. Gameplay and maneuverability are slightly slower than the original, but still quite challenging enough for any gamester. A local Zaxxon addict was very impressed with this version. It's truly a worthy addition to any C-64 gamer's software library. *(Synapse Software, 5221 Central Ave. #200, Richmond, CA 94804. $39.95.)*

Robert Baker
Atco, NJ

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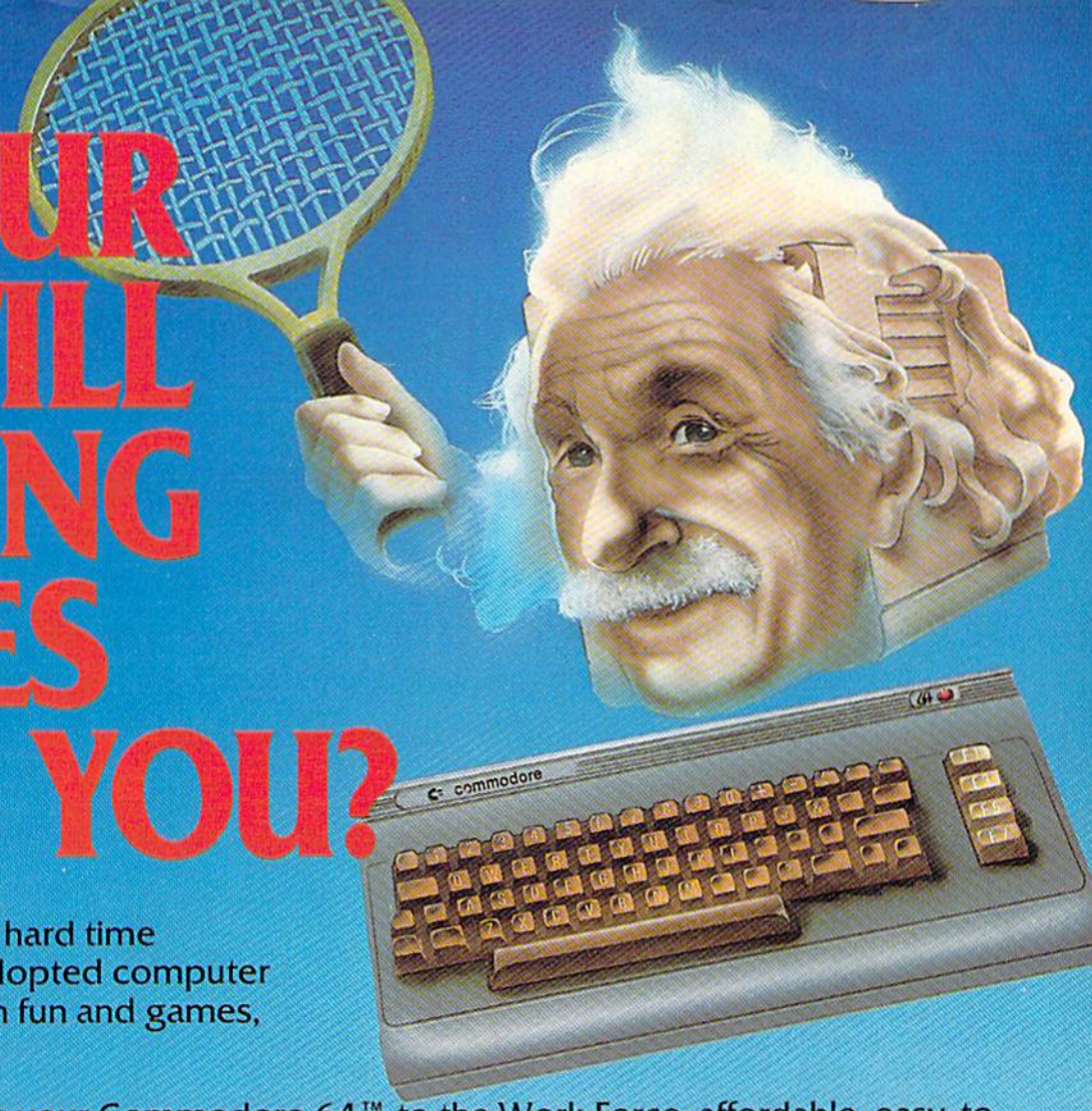

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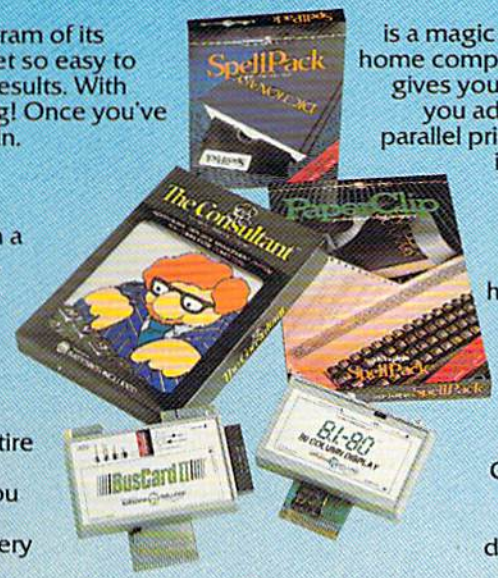

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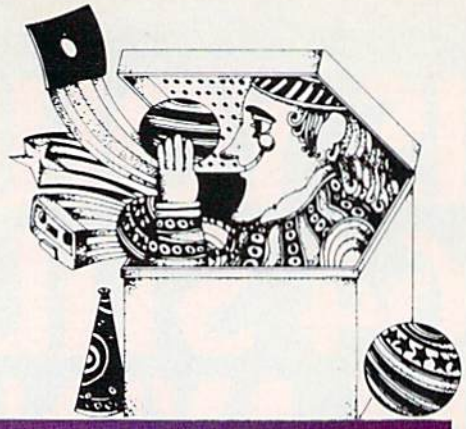


VIDEO CASINO

By David D. Busch

Chicken Little would be wrong. It's not the sky that's falling, but only towns and monuments. Before they hit the ground, however, you'd better know what state they're from—and hit those keys fast!

Geography Invaders presents you with a trio of menacing monsters that descend the screen of your Commodore 64 or VIC-20 at varying rates. You suspect that something terrible will happen if any of them reach the ground. How to stop them?

Hmmm... looking a little closer at the invaders reveals that each is the name of a city, place or famous site in the United States. They have names like Akron, Carlsbad Caverns and Sears Tower. The only way you can stop the invaders is by rapidly typing in the name of the state in which they're located. When you do this, that alien will be vanquished, a new one will take its place and all three will start again from the top of the screen.

If an invader reaches the ground, you lose one of your three lives. If you lose all your lives, you're defeated and the game ends. If you can stop all the aliens, you win the game.

Cursor Control

The questions and answers used in this program are stored in pairs in a string array. In this case, the array is called GEO$(ROW,COL), and each place and state are loaded into it (e.g., Akron, Ohio and Albuquerque, New Mexico).

To present the questions, I've defined three columns on the screen, at column positions 1, 15 and 25 (columns 1, 6 and 11 on the VIC-20). The invaders are confined to these columns, although the rows in which they appear will increase as they descend the screen.

I use a unique method to print the names of the aliens on the screen. The Commodore 64 and VIC-20 both require some tricky manipulations in order to perform functions that other computers may have built in.

For example, some computers allow you to move the cursor to a given position and start printing the next character at that position with a simple statement, such as PRINT @ or LOCATE. The latter is preferred because the Locate command lets you specify the row and column to which you'd like to move the cursor.

With the early Radio Shack computers, you could enter PRINT @ at any of more than 1000 screen locations. For instance:

```
10 PRINT @ 0,"HELLO"
20 PRINT @ 64,"HELLO"
```

This would print HELLO at the row 1, column 1, and row 2, column 1 of the screen. This is not ideal, because you need to calculate each starting screen position. You might compare this mode with Poking a character to screen memory with the Commodore computers. For instance:

```
10 POKE P,1
20 POKE P+40,1
```

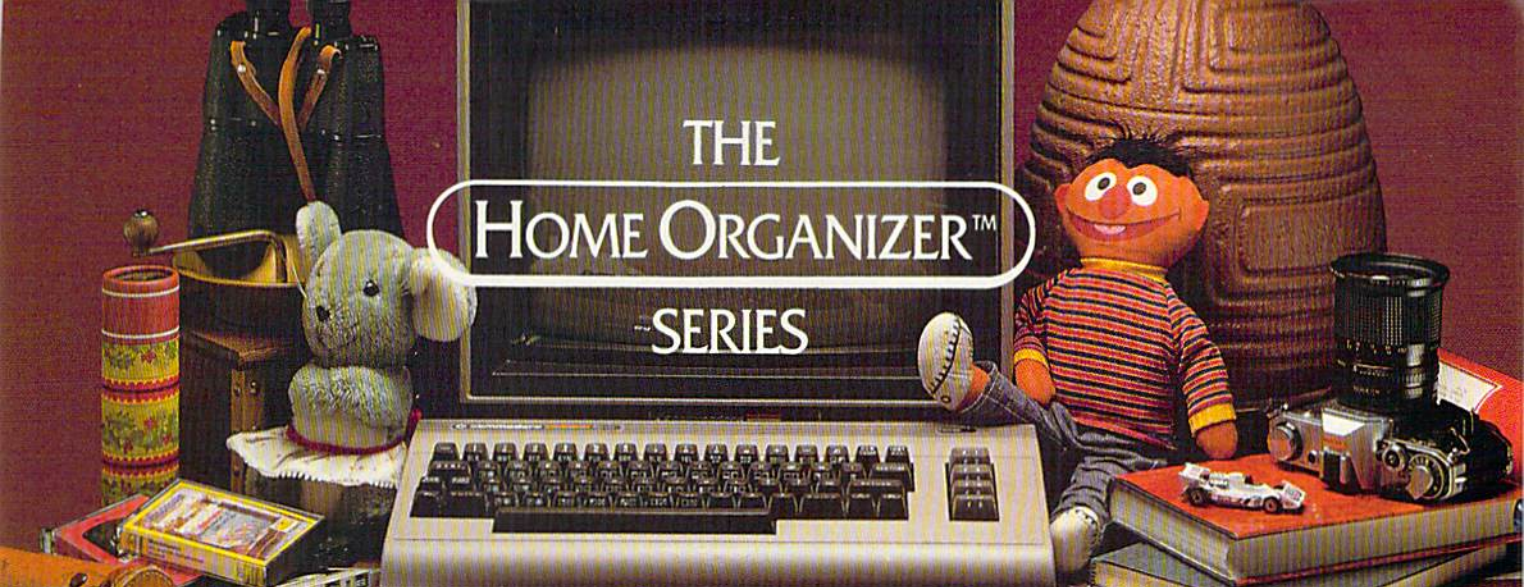
If P had been previously defined in the program as the start of screen memory, then the letter A would be Poked to row 1, column 1, and row 2, column 2 (on the Commodore 64 only—substitute P + 22 for the VIC-20).

Note that you had to figure that row 2, column 2, was P + 40 in order to get the letter in the right spot. Also notice that it's more difficult to print at screen locations with the Commodore computers because each character has to be Poked in turn, and you must also Poke color memory with the character color. Finally, you should be aware that the Commodore Poke codes are not the same as CHR$ codes. The A is CHR$ (65), but has a value of 1 when Poking.

Some computer systems, such as the

RUN It Right

Commodore 64/VIC-20 expanded with 3K



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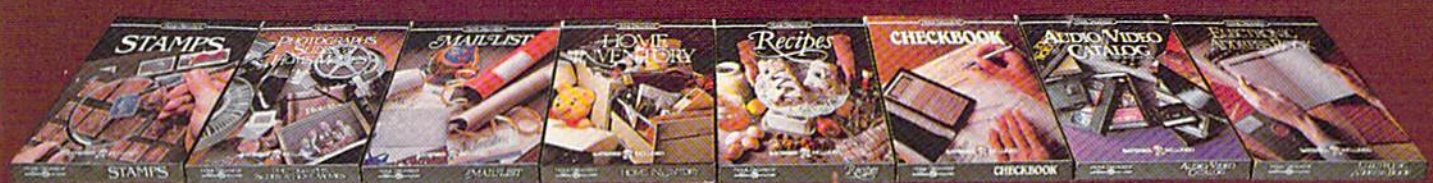

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COMMODORE 64 IS A REGISTERED TRADE MARK OF COMMODORE BUSINESS MACHINES

Listing 1. Geography Invaders program for the C-64.

```
10 REM **********************
20 REM *{20 SPACEs}*
30 REM * GEOGRAPHY INVADERS *
40 REM *{20 SPACEs}*
50 REM **********************
60 REM *** INITIALIZE ***
70 CL$=CHR$(147):DN$=CHR$(17)
80 RT$=CHR$(29):HME$=CHR$(19)
90 LF$=CHR$(157):UP$=CHR$(145)
100 RV$=CHR$(18):OFF$=CHR$(146)
110 WHITE$=CHR$(5):CYAN$=CHR$(159)
120 GOSUB 1580
130 NC=65
140 LIVES=3
150 REM *** INSTRUCTIONS ***
160 PRINT CL$;DN$
170 PRINT TAB(6)"*** GEOGRAPHY INVADERS ***"
180 PRINT
190 PRINT TAB(4)"ENTER THE STATE IN WHICH THE"
200 PRINT TAB(4)CHR$(34);"INVADER";CHR$(34);" IS LOCATE
    D."
210 PRINT
220 PRINT TAB(4)"YOU HAVE THREE LIVES IN WHICH TO"
230 PRINT TAB(4)"KILL 25 INVADERS. GOOD LUCK";DN$
240 PRINT TAB(10)"== HIT ANY KEY =="
250 GET A$:IF A$="" GOTO 250
260 REM *** ENTER DIFFICULTY ***
270 PRINT CL$;DN$;DN$
280 PRINT TAB(8)"ENTER DIFFICULTY:";DN$
290 PRINT TAB(8)"[1] FAST{2 SPACEs}TO{2 SPACEs}[9] SLOW
    "
300 GET A$:IF A$="" GOTO 300
310 DELAY=VAL(A$)*2
320 IF DELAY=0 GOTO 300
330 REM *** READ STATES, SITES INTO ARRAY ***
340 PRINT CL$
350 COL(1)=1:COL(2)=15:COL(3)=25
360 DIM GEO$(NC,2)
370 FOR ROW=1 TO NC
380 FOR COL=1 TO 2
390 READ GEO$(ROW,COL)
400 NEXT COL
410 NEXT ROW
420 PRINT CL$
430 REM *** GEOGRAPHIC INFORMATION ***
440 DATA AKRON,OHIO,ALBUQUERQUE,NEW MEXICO
450 DATA ANAHEIM,CALIFORNIA,ANCHORAGE,ALASKA
460 DATA BALTIMORE,MARYLAND,BUFFALO,NEW YORK
470 DATA CHARLOTTE,NORTH CAROLINA,CHICAGO,ILLINOIS
480 DATA CORPUS CHRISTI,TEXAS,DALLAS,TEXAS
490 DATA DAYTON,OHIO,DETROIT,MICHIGAN,EL PASO,TEXAS
500 DATA FORT WAYNE,INDIANA,FORT WORTH,TEXAS
510 DATA FRESNO,CALIFORNIA,HUNTINGTON BEACH,CALIFORNIA
520 DATA JACKSONVILLE,FLORIDA,KNOXVILLE,TENNESSEE
530 DATA LEXINGTON,KENTUCKY,LONG BEACH,CALIFORNIA
540 DATA LOS ANGELES,CALIFORNIA,LUBBOCK,TEXAS
550 DATA MADISON,WISCONSIN,MEMPHIS,TENNESSEE
560 DATA MIAMI,FLORIDA,MILWAUKEE,WISCONSIN
570 DATA MOBILE,ALABAMA,NEWARK,NEW JERSEY
580 DATA NEW ORLEANS,LOUISIANA,NORFOLK,VIRGINIA
590 DATA OAKLAND,CALIFORNIA,OMAHA,NEBRASKA
600 DATA PHILADELPHIA,PENNSYLVANIA,PHOENIX,ARIZONA
610 DATA PORTLAND,OREGON,SAINT LOUIS,MISSOURI
620 DATA SAN DIEGO,CALIFORNIA,SAN FRANCISCO,CALIFORNIA
630 DATA SANTA ANA,CALIFORNIA,SEATTLE,WASHINGTON
640 DATA SHREVEPORT,LOUISIANA,SPOKANE,WASHINGTON
650 DATA SYRACUSE,NEW YORK,TAMPA,FLORIDA,TOLEDO,OHIO
660 DATA TUCSON,ARIZONA,TULSA,OKLAHOMA,WICHITA,KANSAS
670 DATA YONKERS,NEW YORK,U.S. CAPITOL,"WASHINGTON,D.C.
    "
```

More

If an invader reaches the ground, you lose one of your three lives.

IBM, use a row and column method for addressing the screen. For instance:

```
LOCATE 1,1: PRINT "HELLO"
LOCATE 2,1: PRINT "HELLO"
```

This will function the same as the first example above, except that you needn't calculate any screen positions. This feature is very nice for moving objects on the screen, because you can use variables, such as ROW and COL, and change them. If you want the object to move to the right, you make COL = COL + 1. To move it to the left, make COL = COL − 1. Going down? Just make ROW = ROW + 1. You get the idea.

Geography Invaders brings this feature to the Commodore 64 and VIC-20. Your computer has a handy cursor-control feature that will move the cursor down one row, up one row and one column right or left, as desired. To simulate the Locate function, you must do the following.

- Decide which row and which column you want the cursor to appear in.
- Move the cursor to the home position. This can be done by printing CHR$(19), the home character.
- Move the cursor COL characters to the right.
- Move the cursor down ROW number of rows.
- Then start printing at that point.

This is much easier than it sounds. I'll take it slow so you can follow what happens, using the Commodore 64's 40-character-wide screen as an example.

How It Works

First, you build a string that will move the cursor back to the home position, without erasing the screen. This string will also include enough of the CRSR RT symbols to move the cursor all the way to the right side of a single row. So, this variable, R$, will equal 1 CHR$(19) (HOME) plus 40 CHR$(29) (CRSR RT). This can be built as follows.

```
10 R$ = CHR$(19)
20 FOR N = 1 TO 40
30 R$ = R$ + CHR$(29)
40 NEXT N
```

If you then included PRINT R$ any-

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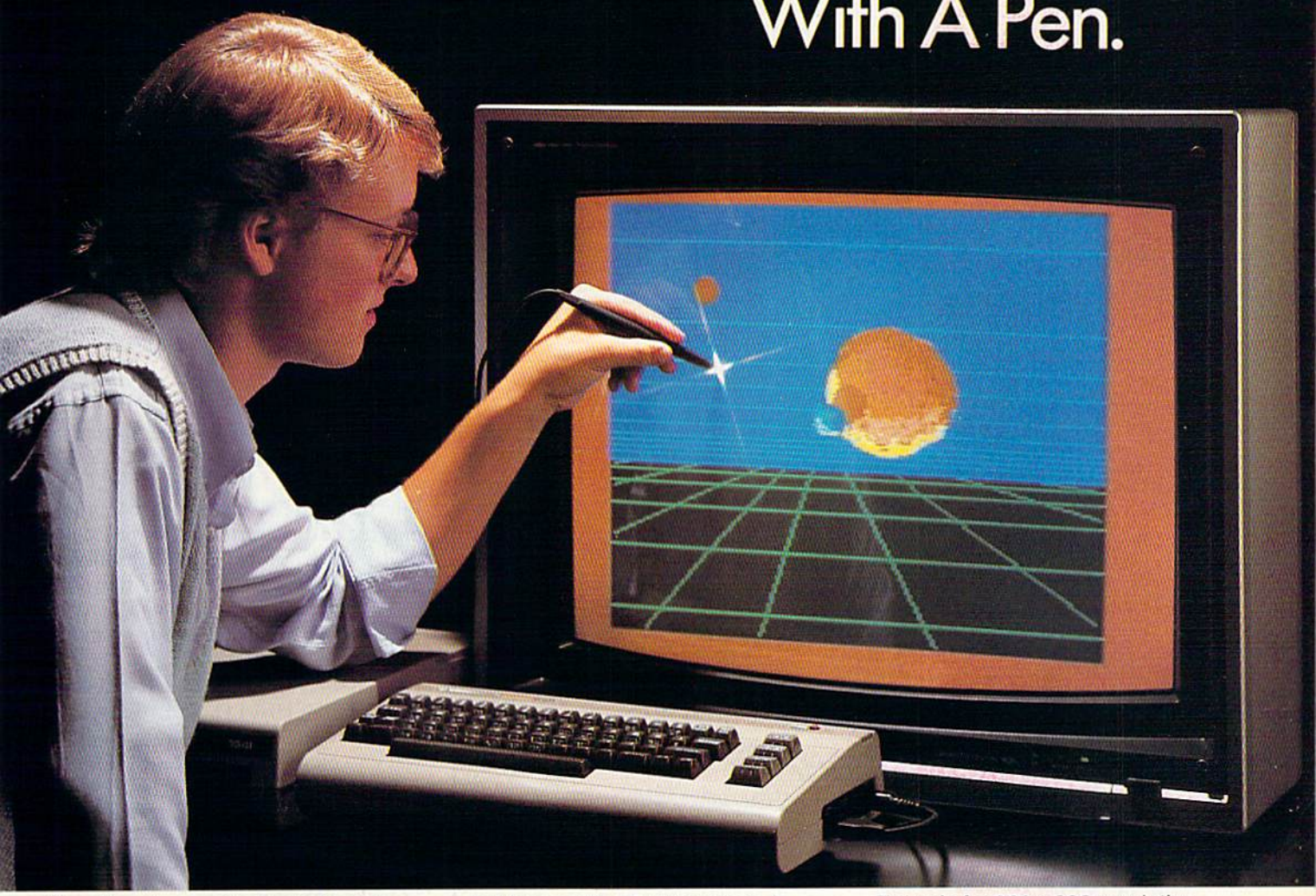

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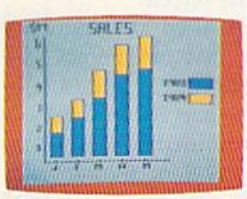

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Listing 1 continued.

```
68Ø DATA KENNEDY SPACE CENTER,FLORIDA,LIBERTY BELL,PENN
    SYLVANIA
69Ø DATA PLYMOUTH ROCK,MASSACHUSETTS,MAMMOTH CAVE,KENTU
    CKY
7ØØ DATA JOHNSON SPACE CENTER,TEXAS,DEATH VALLEY,CALIFO
    RNIA
71Ø DATA GREAT SALT LAKE,UTAH,MOUNT MCKINLEY,ALASKA
72Ø DATA CARLSBAD CAVERNS,NEW MEXICO, THE EVERGLADES,FL
    ORIDA
73Ø DATA EMPIRE STATE,NEW YORK,DISNEY WORLD,FLORIDA
74Ø DATA NIAGARA FALLS,NEW YORK,GRAND CANYON,ARIZONA
75Ø DATA SEARS TOWER,ILLINOIS
76Ø GOTO 81Ø
77Ø R=INT(RND(1)*NC)+1
78Ø IF GEO$(R,1)="" GOTO 77Ø
79Ø RETURN
8ØØ REM *** SET UP THREE INVADERS ***
81Ø FOR N=1 TO 3
82Ø GOSUB 77Ø
83Ø INVADER$(N,1)=GEO$(R,1):INVADER$(N,2)=GEO$(R,2)
84Ø GEO$(R,1)=""
85Ø NEXT N
86Ø REM *** START ROUND, MOVE INVADERS ***
87Ø PRINT CL$
88Ø GOSUB 166Ø
89Ø R(1)=1:R(2)=1:R(3)=1
9ØØ Q=INT(RND(1)*3)+1
91Ø GET A$:IF A$<>"" THEN GOSUB 115Ø
92Ø IF R(1)=25 OR R(2)=25 OR R(3)=25 THEN GOSUB 1Ø5Ø
93Ø PRINT LEFT$(R$,COL(Q));
94Ø PRINT LEFT$(D$,R(Q));
95Ø FOR S=1 TO LEN(INVADER$(Q,1))
96Ø PRINT CHR$(32);
97Ø NEXT S
98Ø R(Q)=R(Q)+1
99Ø PRINT LEFT$(R$,COL(Q));LEFT$(D$,R(Q));
1ØØØ PRINT INVADER$(Q,1);
1Ø1Ø GOSUB 172Ø
1Ø2Ø FOR N=1 TO DELAY:NEXT N
1Ø3Ø GOTO 9ØØ
1Ø4Ø REM *** INVADER REACHED GROUND ***
1Ø5Ø PRINT CL$
1Ø6Ø PRINT TAB(2)"YOU HAVE LOST A LIFE, CARELESS HUMAN!
    ";
1Ø7Ø GOSUB 182Ø
1Ø8Ø FOR N=1 TO 1ØØØ:NEXT N
1Ø9Ø PRINT CL$
11ØØ GOSUB 166Ø
111Ø LIVES=LIVES-1
112Ø IF LIVES=Ø GOTO 143Ø
113Ø R(1)=1:R(2)=1:R(3)=1:GOTO 14ØØ
114Ø REM *** LETTER IS ENTERED ***
115Ø IF A$=CHR$(13) THEN GOTO 125Ø
116Ø IF A$=CHR$(32) THEN GOTO 119Ø
117Ø A=ASC(A$)
118Ø IF A<65 OR A>9Ø THEN RETURN
119Ø AN$=AN$+A$
12ØØ PRINT HME$;
121Ø PRINT AN$;
122Ø PRINT TAB(25)RV$;WHITE$;"LIVES :";OFF$;CYAN$;LIVES
    ;
123Ø RETURN
124Ø REM *** CHECK ANSWER ***
125Ø IF RIGHT>13 THEN GOTO 15ØØ
126Ø IF AN$=INVADER$(1,2) THEN AN=1:GOTO 133Ø
127Ø IF AN$=INVADER$(2,2) THEN AN=2:GOTO 133Ø
128Ø IF AN$=INVADER$(3,2) THEN AN=3:GOTO 133Ø
129Ø AN$=""
13ØØ PRINT HME$;"{17 SPACEs}";:PRINT HME$;
131Ø RETURN
132Ø REM *** CORRECT ANSWER ***
```

Sometimes you're unable to see a word until it moves again.

where in your program, the cursor would immediately move to the upper left-hand corner of the screen, without erasing what is already there, and then move over 40 positions to the right. This would happen so quickly that you wouldn't even notice.

What if you don't want the cursor in column 40? What if COL were to equal 20? You'd use LEFT$ instead. For instance:

```
100 PRINT LEFT$,(R$,COL);"HELLO"
```

Watch carefully. The cursor moves to the upper left, as before, because the first character of R$ is still CHR$(19). But then, the Commodore 64 prints only the next characters up to the length COL, which will be COL – 1 examples of CRSR RT. So the cursor moves a total of COL – 1 spaces to the right, and printing begins at the next position, which is COL.

Therefore, by using line 100 above, you can print HELLO at row 1 and column number COL almost instantly. But you say you want a row different from 1?

Build a second variable, D$, which is equal to 25 CRSR DN symbols, or CHR$(17). If you want row 10, then ROW will equal 10. Your program lines will look like this:

```
100 PRINT LEFT$(R$,COL);LEFT$(D$,ROW);
  "HELLO"
```

The cursor will then move to the home position, move over COL columns and down ROW rows, allowing you to begin automatically printing at ROW, COL. Presto! You have added LOCATE.

The technique works exactly the same with the VIC-20, except that you must move over only 22 columns in order to move the cursor from the left edge to the right side of the screen.

This technique is used in Geography Invaders. Three invader names are chosen by accessing three times a subroutine at line 770 (line 780 in the VIC-20 listing). This routine chooses a random number, R, and, if that invader has not previously been chosen, GEO$(R,1) becomes a given alien name, INVADER$(n,1). The answer needed to

(continued on p. 126)

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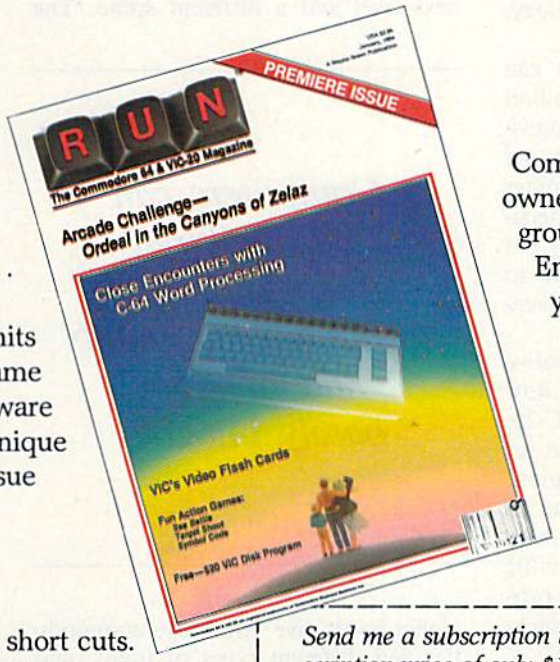

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Computer Tutor

By Christine Adamec

RUN *continues this bi-monthly column that reviews educational software for children.*

As a parent, you love to inspire your children onward to great things. Can your home computer help? Seymour Papert, noted computer expert from the Massachusetts Institute of Technology, thinks the answer is yes.

According to Papert, children can use computers to manipulate symbols and grasp ideas their minds could previously barely imagine. Says Papert, we have "some real hope for the computer not being just another accidental technology that might help education, but *the* technology that comes just now to fill the identifiable gap in the educational world."

The key is good software. Innovative educational programs exist right now for the Commodore 64 and VIC-20, and more will be written as demand for them increases. If your children aren't already using educational software in school, maybe you'd like to start them off at home. This month, I'll describe four superior problem-solving programs, each requiring varying degrees of abstract thinking.

Trains

Trains, from Spinnaker Software (Kendall Square, Cambridge, MA 02139; $39.95, disk), is a fascinating program for the C-64. Children (ages 10 and up) may have trouble wresting the joystick away from Dad or Mom, it's that good!

In Trains, you perform the roles of train engineer, business manager and a few others as well. (Start with the Demo mode, to get a feel for the game.)

There are eight levels of difficulty, and you'll start off in the Old West town of Winnemucca, with $1000 and four oil cars. Moving the train with your joystick, your job is to fill up your cars with oil and deliver them to the refineries. You must remember to fuel up on coal periodically, and you're also charged payroll expenses of $200 every so often. (But it's not all hard work—as you chug along, press the joystick button to blow the train's whistle!)

Once you master Winnemucca, tracks are added on and you're moved to the next level and a different scene. The higher levels give you more commodities and different types of trains, and your goal is to pick up everything and deliver it all to the right places. You must also keep in mind how much money you have left—you don't want to go bankrupt. (Basic economics was never this much fun before!)

Computers can help children grasp ideas and symbols their minds could previously barely imagine.

Push the space bar for a display of how full your trains are. Press it again, and you'll get a bar graph of how much is available in your sources and markets. This game's high-resolution graphics, sound effects and music are outstanding. (Your child might find himself humming the theme song later!) This program requires you to think, analyze and make decisions, and it's challenging, fun and a confidence-builder.

One warning: if your child demands the instant gratification of an easy kill-the-aliens game, he might not have the patience and concentration for Trains.

The Factory

The Factory, available on C-64 disk from Human Engineered Software (150 North Hill Drive, Brisbane, CA 94005), is a unique program in which your child sets up his or her very own factory and builds a product.

First, you must select a machine to test. Your options are the rotating machine, the punch machine or the stripe machine. Use the < and > keys to move the cursor over your choice, then press the return key.

If you want the rotating machine, how many degrees do you want it to turn (45, 90, 135 or 180)? If you want the punch machine, do you want square or circular punches? And how many (one, two or three)? As for the stripe machine, do you want a thin, medium or thick stripe? Each machine has its own factory-like sound effects.

Now you'll be ready to build a factory, and you can select up to eight machines. You choose which ones, including number of punches and so on. After you've set up your factory, the slab of raw material moves through each machine. You can hear it and see the machines turning and moving, but you can't see the material until it's all finished. It glides through the machines on its side, and then seems to turn around to face you when it's done. Learn to create your own design, or reproduce one from the manual.

The ten-year-olds to whom I showed this program could barely wait the minute or so it took for their final product to come out. Okay, here it is—ta da! Many oohs and ahs. Want to duplicate it? How about challenging a friend to recreate your masterpiece? No problem. And if you get it wrong, you're told that

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your product has a flaw—want to try again?

The third part of The Factory is "make a product," and you first decide whether you want the easy, medium or hard level. (And the hard one *is* hard, parents!) You'll see a product on your screen, and your job is to duplicate it. Figure out which machines to use, the numbers of punches and the right order of the machines.

I have one criticism of this unusual program. What if you keep creating a flawed product, no matter how hard you try? I'd like an option of asking the computer for a correct way to do it—I think this would alleviate frustration.

Although the box says this game is for children aged seven and up, several teachers told me that children usually don't learn about the concept of degrees until nine or ten years of age. (Could this be one of those abstract ideas Papert said computers can help our children understand early?)

Alphabet Zoo

Here's a C-64 game for your younger children, aged 3–8: Alphabet Zoo, from Spinnaker Software (Kendall Square, Cambridge, MA 02139; $29.95 disk, $34.95 cartridge).

You start out with the menu and can choose whether you want one or two players (two players can use two joysticks), which of six creatures you'd like to move through the maze, the level of difficulty (from 1–6) and whether you'd prefer game 1 or 2.

After you've made those decisions, press the joystick button. You'll see a maze with a picture in the center and letters displayed throughout the maze. The creature you've chosen waits at the maze's entrance, and you must move him through the maze, zapping the right letters with a press of the joystick button. (Wait too long and your letter moves!)

In game 1, you go for the first letter of the word represented by the picture; for example, zap the Fs if a fox is your creature. In game 2, however, you must spell out the whole word. At the lower levels, you get easy pictures, like a dog, but at the higher levels of both games 1 and 2, you get more difficult ones, like pumpkin, valentine, submarine, and so on.

You have a limited time to move through each maze (a counter is displayed on the top of the screen), and your goal is to earn as many points as possible. Press the joystick button when your man is over the wrong letter, and you lose 10 points. (Correct answers earn 10 points, and if you finish before

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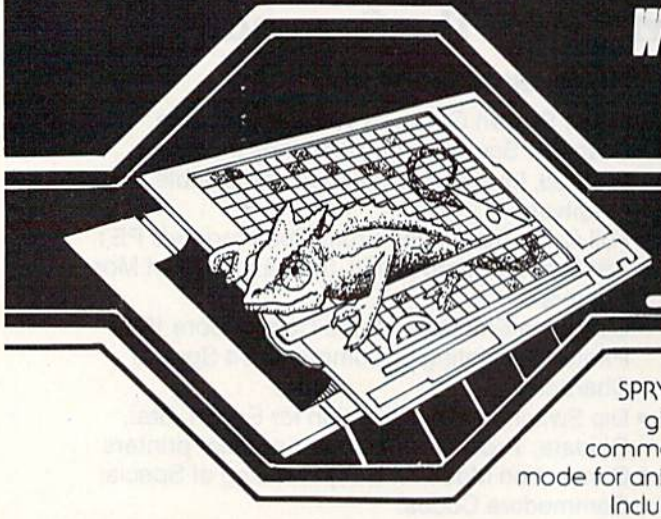

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your time is up, you get extra points.)

There's some strategy to the game, too—if you don't think you can make it in time to the letter, you can move your man to the puffball-like figure, and you'll automatically get moved somewhere else in the maze (maybe where you want to go, maybe not).

My own five- and six-year-old children love this game. I also brought the program to a second-grade class to see what they thought. They were extremely enthusiastic, arguing over whose turn it was to play next. Later they evaluated it as "great" and "excellent."

Spills and Fills

For all you VIC-20 lovers out there who've felt ignored—here's a program for your kids. (Note: the next column will be dedicated to VIC-20 programs only.) It's Spills and Fills, a game from Creative Software (230 East Caribbean Drive, Sunnyvale, CA 94089; $29.95, cartridge) for children of ages 6–12.

The game includes two levels of difficulty: regular shapes and "crazy" shapes. You use the joystick to hook up a master beaker to a crane and then to move the beaker to the master faucet, where you fill it up by pressing the joystick button. You must fill up as many beakers and shapes as possible without spilling (it's harder than it sounds). The screen provides your score in "fills" and "spills." The sound effects when the beaker is filling (or spilling) are very good.

The program reinforces learning of spatial relationships and good "rules of thumb" in selecting the right-sized beakers to fill the various shapes. (The game's much harder with the crazy shapes.) Once you decide to fill, you can't stop midway—you're committed. And if you've filled from too large a master beaker and try to pour into a smaller shape, then the entire contents are dumped out.

Your ultimate aim: fill everything up, master beakers and shapes. It's a good game that requires your child to exercise those brain cells. R

Christine Adamec (1921 Ohio St. NE, Palm Bay, FL 32907) is a professional writer, with articles in McCall's, Graduating Engineer, In Business *and* RUN *to her credit. As the mother of two children, ages five and six—who frequently serve as her guinea pigs for testing—she has become particularly intrigued with the subject of children's software. She eagerly invites readers to send in their comments on this column's content.*

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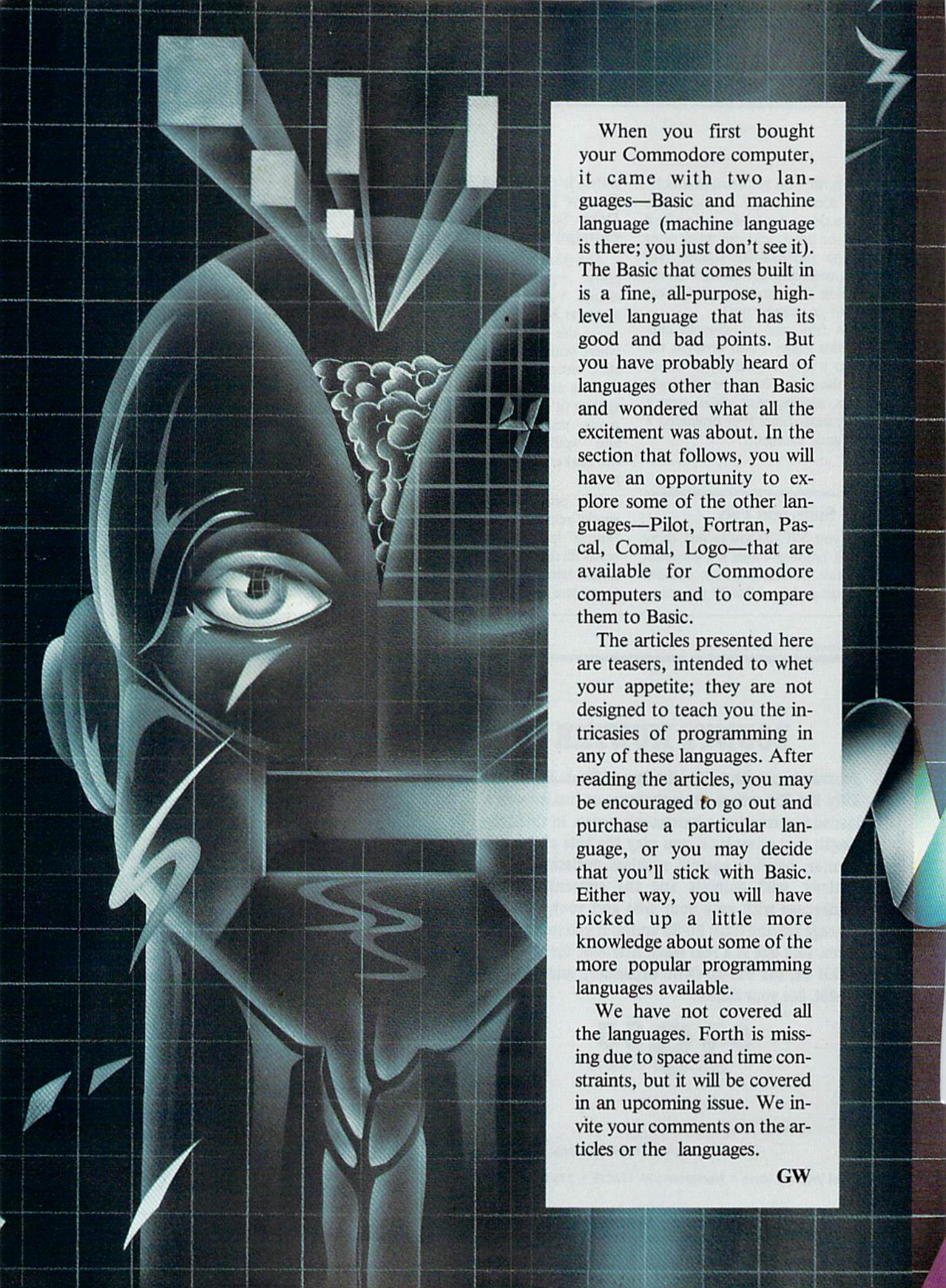


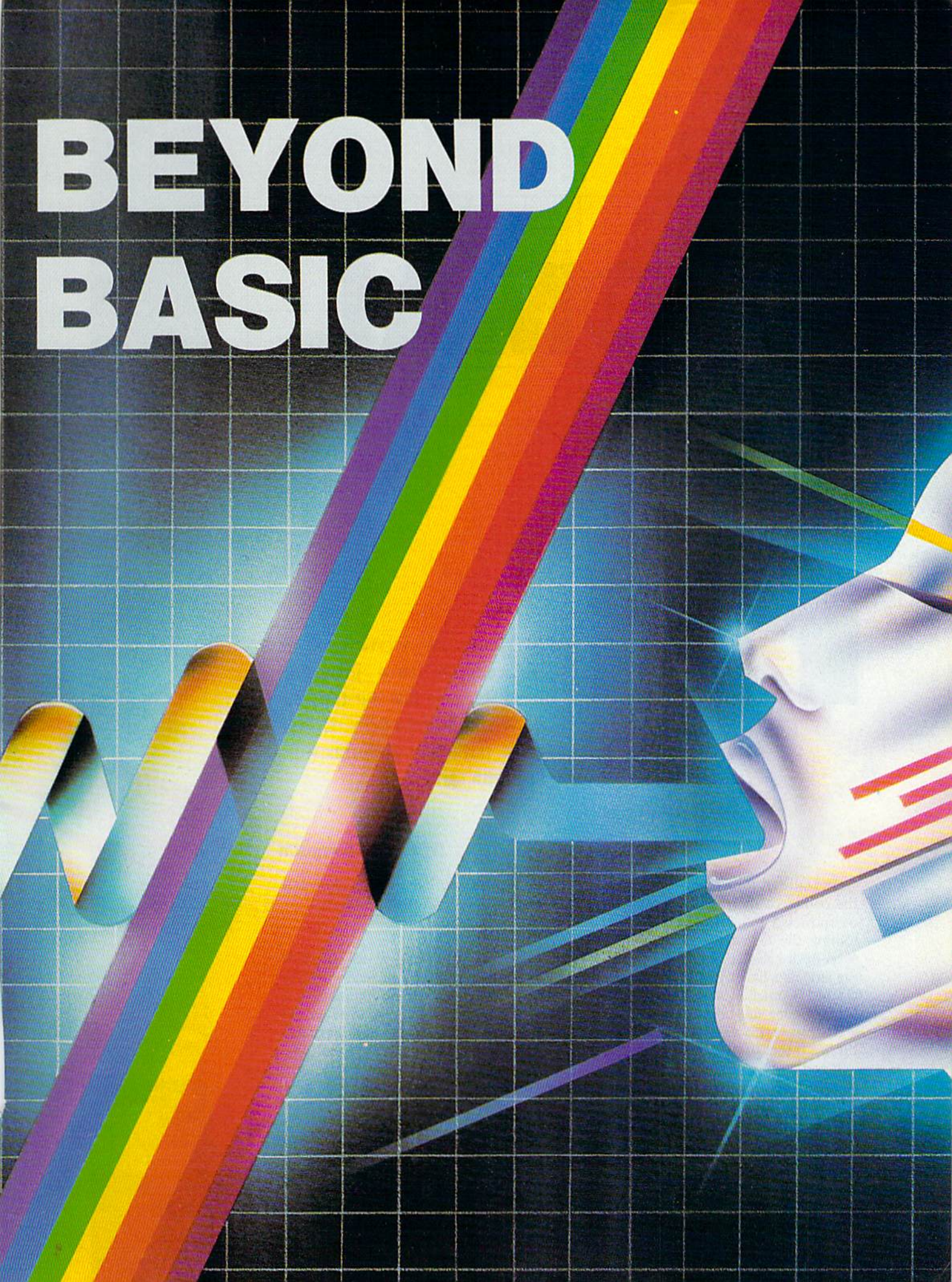
When you first bought your Commodore computer, it came with two languages—Basic and machine language (machine language is there; you just don't see it). The Basic that comes built in is a fine, all-purpose, high-level language that has its good and bad points. But you have probably heard of languages other than Basic and wondered what all the excitement was about. In the section that follows, you will have an opportunity to explore some of the other languages—Pilot, Fortran, Pascal, Comal, Logo—that are available for Commodore computers and to compare them to Basic.

The articles presented here are teasers, intended to whet your appetite; they are not designed to teach you the intricasies of programming in any of these languages. After reading the articles, you may be encouraged to go out and purchase a particular language, or you may decide that you'll stick with Basic. Either way, you will have picked up a little more knowledge about some of the more popular programming languages available.

We have not covered all the languages. Forth is missing due to space and time constraints, but it will be covered in an upcoming issue. We invite your comments on the articles or the languages.

GW

BEYOND BASIC



COMAL

Here's an overview of an easy-to-learn programming language that outstrips Basic in speed and clarity. It even has a turtle and performs wonders with sprites.

By Colin Thompson

The little ad for Comal was nestled in the corner of the page, nearly hidden, overpowered by the four-color eyesore touting the Game of the Century. A sneer of disbelief curled my lips as I read the little ad's list of fantastic features. It claimed Comal 0.14 was a high-level programming language, designed to be a complete replacement for Basic. Ha! I'd heard that one before.

It was a hybrid language, the ad said, constructed from the best parts of Basic, Logo and Pascal, all for only $20. The built-in features seemed too good to be true. I didn't believe what I was reading, so I sadly filed Comal away with the other curiosity languages that had piqued my interest but ultimately failed to deliver on their promises.

Joy of Discovery

Three months later, a disk copy of Comal 0.14 arrived in the mail, courtesy of my local user's group librarian. The accompanying letter (written by an old PET person) praised the new language. I loaded Comal, ran the demo programs, heaved a huge sigh of relief and set out to learn the language. That night I discovered the joy of structured programming.

All the commands to control the C-64's sprites, high-resolution screen and X-Y graphics were built into the

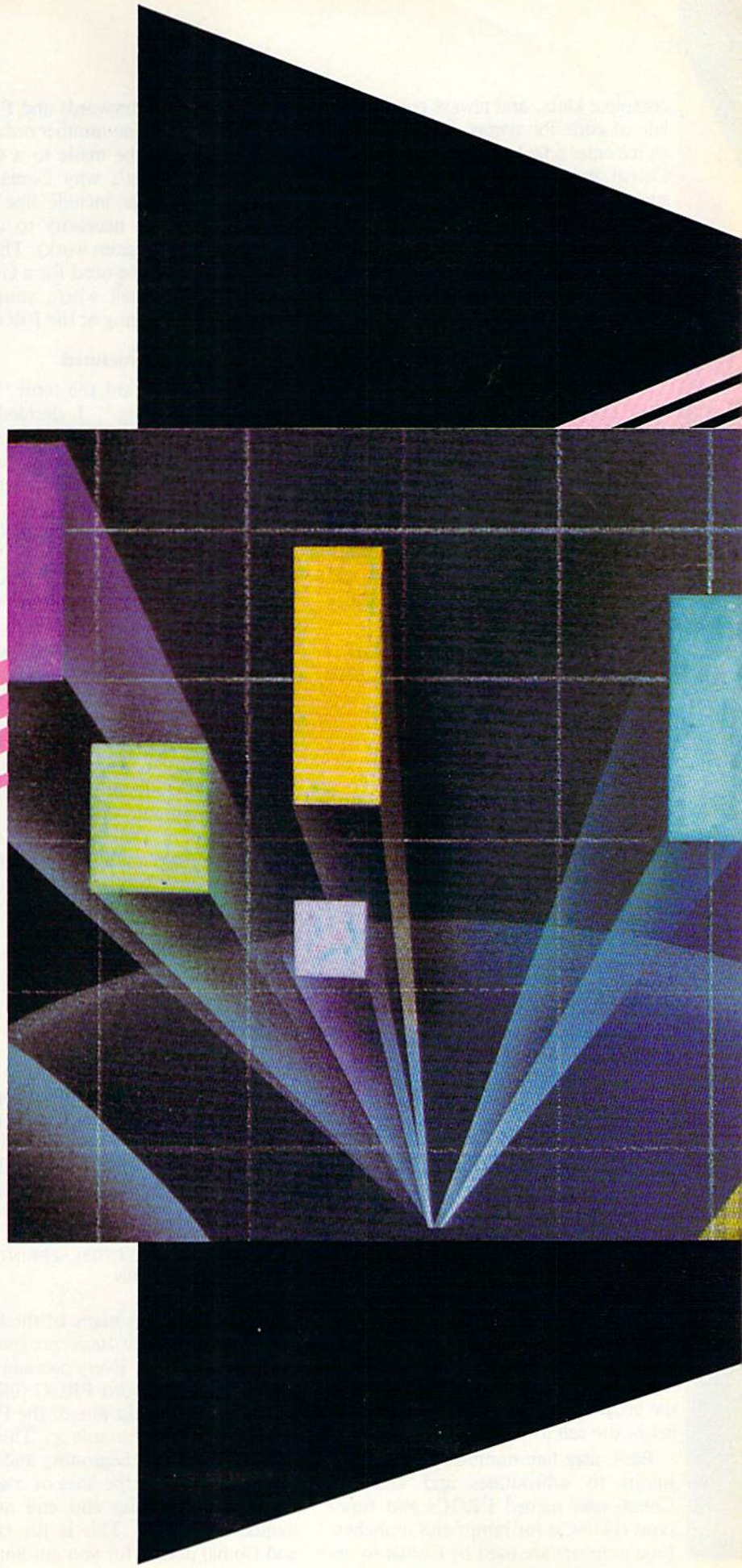
language, whereas Commodore omitted these useful commands from Basic 2.0's repertoire, forcing us to resort to Peeks and Pokes. C-64 Comal version 0.14 is a learning language. The real Comal (version 2.0) is being tuned up for release by Commodore later this year as a 64K ROM cartridge.

Armed with Roy Atherton's *Structured Programming With Comal*, I spent two weeks getting familiar with the new language. Roy's book covers Comal, not the C-64. Graphics, sprites, color and the musical abilities of the Commodore were not addressed, so I contacted the Comal User's Group to see if a book on C-64 Comal was available. There was one, called the *Comal Handbook*. I also found that their newsletter, *Comal Today*, was all about Comal on the Commodore, so I ordered both.

The newsletter proved to be a treasure trove of information. A month later I was writing Comal programs of the same complexity that had taken me years to create in Basic. The little ad was not outrageous after all, but actually understated.

Comal was just what I had been looking for. Its deceptive power may lull you into thinking it's another version of Logo, or a simplified Pascal, or worse, the ultimate Basic for the C-64. Comal is a little of all those and more. The language was conceived and designed ten years ago by a Danish educator, Borge Christianson. He was forced to teach Basic as a first language because Pascal is far too complex to inflict on a novice programmer. There was no intermediate language that provided Basic's ease of use and Pascal's structure, so he invented Comal to fill the slot.

In the years following, Comal has been refined, defined, standardized and enhanced, but still plays the same role: a first language, easily learned and taught. Hidden behind the deceptive label "learning language" lies a powerful programming tool, capable of displacing Basic.



Is It Hard to Learn?

Any language is difficult at first, but the pain of learning may be eased by a forgiving language. Comal is the most gentle language I use. The operating system assumes the programmer is a

complete klutz, and always checks each line of code for syntax errors. It won't let me enter a faulty line. Since I came to Comal from Basic, I had to unlearn some bad habits and relearn where the commas and other punctuation went.

Looking back, the experience was fun and rewarding. If you choose Comal as a first language, you must simultaneously learn about programming and the computer hardware. This is not an impossible task; I learned Basic this way.

Comal sets itself apart from Basic because it employs our native tongue, English, rather than the cryptic shorthand notation that makes Basic unreadable. Each line of Comal code is allowed only one command, or keyword. Basic lets you cram in as many commands as will fit on an 80-character line, the commands all separated by colons. An example of both will show what clarity really means:

```
10 OPEN4,4:GOSUB6021:PRINT#4,CHR$(12):
   GOSUB2265:PRINT#4,HE$:CLOSE4:GOTO
   3398
```

and now in Comal:

```
select "lp:"     // open the printer channel
sort'list        // put the data in order
page             // send a form feed to the printer
print'the'list   // send the data to the printer
page'number      // print the page number
select "ds:"     // close the printer channel
main'menu        // job is done. return to the menu
```

The // means Remark. Both languages did the same job, but which one is easier to read? Right. By placing the keywords vertically, one to a line, you can follow the flow of the program. A Comal program may be read like a good book. Notice that the keywords read like English.

Before we get too far, I must confess I've tricked you. The only keywords (commands) in the Comal program above are select "lp:" and select "ds:". These are standard keywords, understood by Comal. The others (page, main'menu, etc.) are procedures, named by the programmer to describe their functions and executed by simply placing them on a line. Procedures (PROCs) are exactly like subroutines. They're called by name instead of line number, and when they finish their job, the program jumps to the next keyword below the call to the PROC.

Basic uses line numbers to reference jumps to subroutines and GOTOs. Comal uses named PROCs and functions (FUNCs) for jumps and branches. Line numbers are used by Comal to organize the list of keywords and PROCs to be executed in line-number order, but no reference can be made to a Comal line number. That's why Comal program listings never include line numbers. They aren't necessary to understand how the program works. This also neatly eliminates the need for a GOTO. You can always tell where your program went by looking at the PROCs.

Simplified, Not Structured

When I first heard the term "structured programming," I decided that whatever it was, I didn't like the sound of it. The term structured evoked the image of rules, complex mathematics and a master's degree in Boolean logic. As usual, my fears of the unknown proved groundless.

Comal is a high level, structured language, all right, but high level simply means you can accomplish many tasks with a single keyword, and structured means simplified. Comal simplifies your chore by letting you break up the task at hand into several smaller jobs, the PROCs. The PROCs are called in the order necessary to accomplish the larger task. That's really all there is to structured programming with Comal.

Let's look at a sample PROC to see how it's constructed. This one may be called anytime you want the screen, border and cursor colors changed:

```
proc change'colors
  //
  border 7          // yellow border
  background 14     // lt green screen
  pencolor 0        // black cursor
  //
endproc change'colors
```

The remarks (//) were added for clarity and don't slow down the program. Whenever PROC change'colors is called, the three colors will be changed and then the program continues. In Basic it would look like this:

```
6000 POKE53280,7:POKE53281,14:PRINT
     "[black]";:RETURN
```

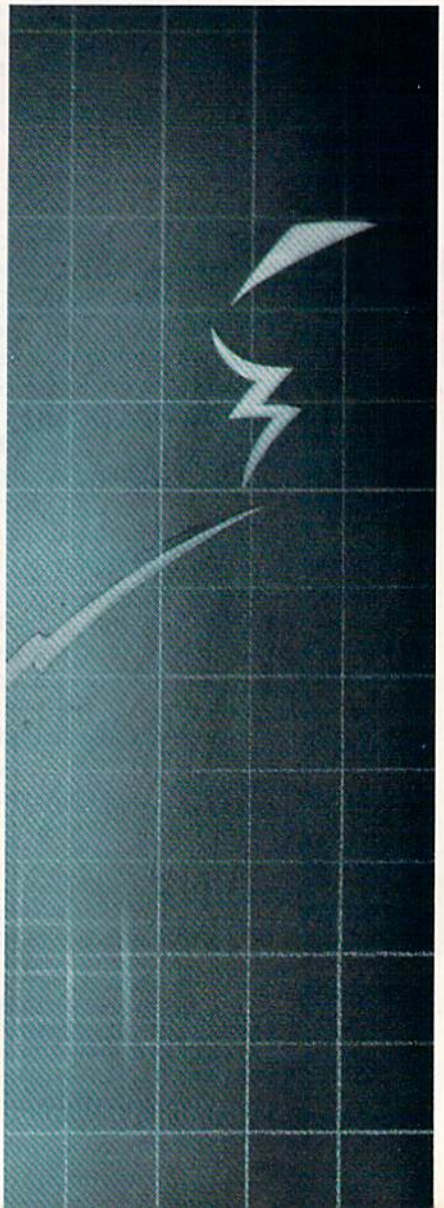
Comal eliminates many of the Pokes and Peeks that the Basic programmer must contend with. Every procedure begins with the keyword PROC followed by its name. The last line of the PROC says ENDPROC <name>. This is a structure. It has a beginning and end.

Also notice that the lines of code between the beginning and end are indented one space. This is for clarity, and Comal does it for you automatically. Comal is recursive, which just means that PROCs can call themselves.

A Programmer's Playground

Comal 0.14 is smart. It lets you concentrate on the logic of the code, freeing you from much of the housekeeping that wastes time. Simple things, missing from Basic but present in a hundred Basic extensions, are built into Comal. Automatic line numbering eliminates a lot of possible keying errors; lines may be deleted singly or by a range; and full screen editing, à la Basic, makes it easy to change lines.

As mentioned, Comal checks each line of code as you enter it. If a syntax error is found, an English-language error message appears on the screen on the next line. The cursor is placed directly on the offending keyword, and you are given the chance to make the



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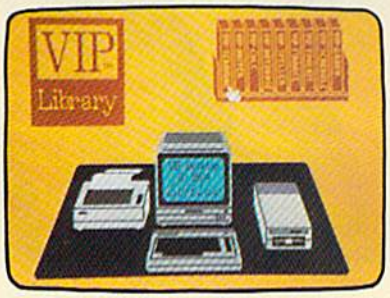

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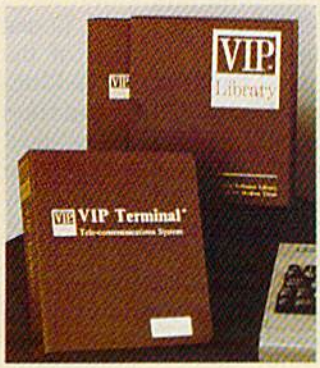

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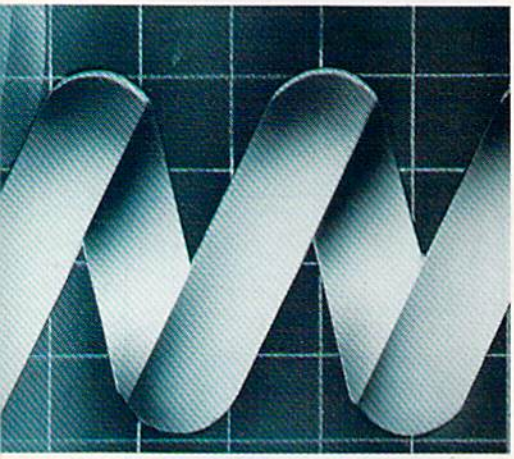
correction. After you correct the error, the error message disappears and the text it overwrote is replaced.

Structure problems (a missed ENDPROC, ENDCASE, etc.) will be found when you run the program. This is the second check. Comal continues to check the performance of the program while it is running and will report any other problems as it finds them. This could include a self-modification or an out-of-range value.

Long variable names, up to 78 characters, with each digit significant, help to keep the program legible. Since all variables are tokenized into a single byte, the long names don't eat up valuable memory. Garbage collection is a thing of the past. All the variables, arrays and strings are stored in protected tables. To do this, Comal requires that you DIM a string before using it and declare how long the string is going to be. It looks like this:

```
dim filename$ of 16
```

Real and integer variables don't require this treatment. You can DIM a string anywhere in the program; but for clarity, they should be grouped at the beginning. Strings, variables and arrays



may be global (available to all PROCs), or local (available only to closed PROCs).

Strings may be searched with the powerful In keyword. For example, you may search the string name$ to see if the letters "Jim" are anywhere in that string. If Jim is there, you can replace him with Jan simply by overwriting a section of the string. Those two operations are quite complex in Basic, requiring many bytes of code, whereas Comal gives you the power in a single keyword.

Benchmarks reveal Comal to be as much as 79 times faster at string searches than Basic. Comal 0.14 operates at speeds somewhere between Basic and machine language, depending on what function is being executed. Comal 2.0 runs very close to machine language speed for all operations.

Dealing with peripherals is always a chore in Basic, but Comal relieves you of much of the tedium. To display the disk drive's directory, you use the keyword CAT. The directory rolls onto the screen, but the program in memory is not destroyed. Listing a program to the printer is also easy:

```
select "lp:" // open a CMD channel to the
   printer
list
```

Channel openings and closings are done automatically.

If you love to use sprites, you're going to love Comal.

List and Edit

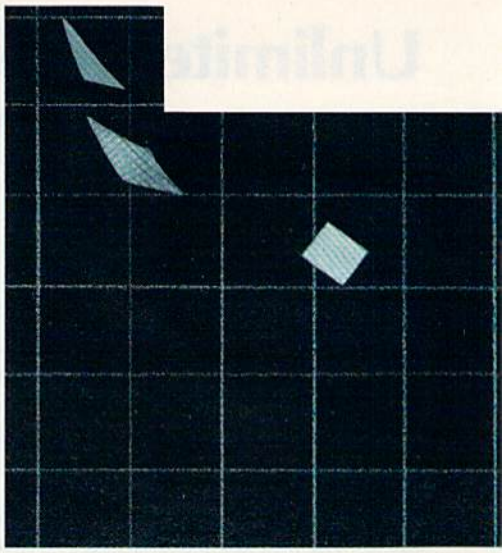
If you list a Comal program to the screen, the line numbers will be displayed and the structures will be automatically indented. The keyword Edit is similar, but the structures will not be indented, allowing you to readily edit a line. The space bar will pause the listing on the screen. A List command can be used to send a program to any device, but a program listed to the disk can be very useful. The syntax is similar to the Save command:

```
list "my'program.l"
```

MY'PROGRAM.L will now be recorded on the disk as a sequential file that may be merged later. The keyword Enter does the trick. PROCs may be listed also, then entered when needed. This reduces program-development time. You could store a disk full of commonly used PROCs or FUNCs and then merge those needed to build a program. PROCs can be made to perform like keywords.

Comal 0.14 is missing only two normally used commands—VAL and STR$. PROCs that emulate these commands have been written and may be merged into a program that needs them.

Comal affords the programmer many ways to test variable conditions inside a loop. Repeat-Until tests the end of a loop. IF-THEN-ELIF-ELSE-ENDIF



will test multiple conditions, but you may use as many lines of code between the IF and ENDIF as needed. The Case structure is used like Basic's ONX-GOTO, except no line numbers are used and any number of PROCs may be called when a condition is met:

```
repeat
   answer$:=key$       // get a keystroke
until answer$ in "ax" // fall through when a or
                         x is pressed
case answer$ of
   when "a"            // an "a" was pressed
      start'program
      check'results
      end
   when "x"            // an "x" was pressed
      print "Ending Program"
      end
endcase
```

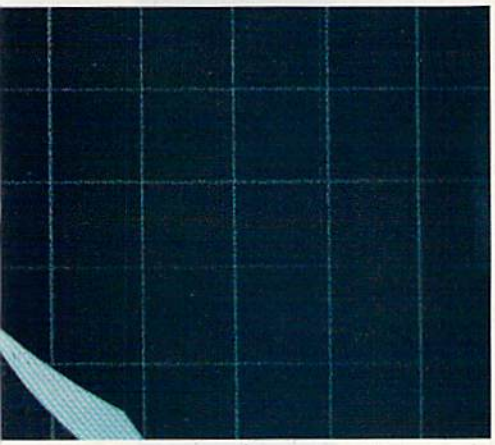
Case makes keystroke evaluation easy. The Repeat-Until loops endlessly until the proper keystroke is pressed. Comal includes two system constants, True and False, to help you make logical tests.

Comal handles the function just like a PROC, except any FUNC (FN in Basic) may be a multiple-line equation, and parameters may be passed into the FUNC. The FUNC returns a value to the calling line.

The Icing on Comal's Cake: Sprites and the Turtle

Apple, Osborne and CP/M Comal users are missing out on most of the fun. They don't have sprites. We Commodore users do, and C-64 Comal takes full advantage. If you've always wanted to use sprites, but found Basic the wrong language to deal with them, you're going to love Comal.

Ten new keywords will give you complete control of every aspect of sprite definition and movement. No more Pokes! Comal has reserved enough



64 Superexpander and Simon's Basic, wrapped up in one neat package. The newcomer to Comal may well learn the language by experimenting with the turtle and X–Y graphics.

So It's Great. What's the Catch?

Lest you think Comal 0.14 is the *perfect* high level language, let me outline its shortcomings. The language is loaded into the C-64 from disk, just like any program, but the loading time is nearly two minutes. Also, Comal does not have any clever keywords to control the SID chip.

As mentioned above, VAL and STR$ are not included, but they may easily be emulated. Only 9902 bytes are free to the programmer, but I've found this to be the equivalent of 18K in Basic, because Comal is so much more powerful.

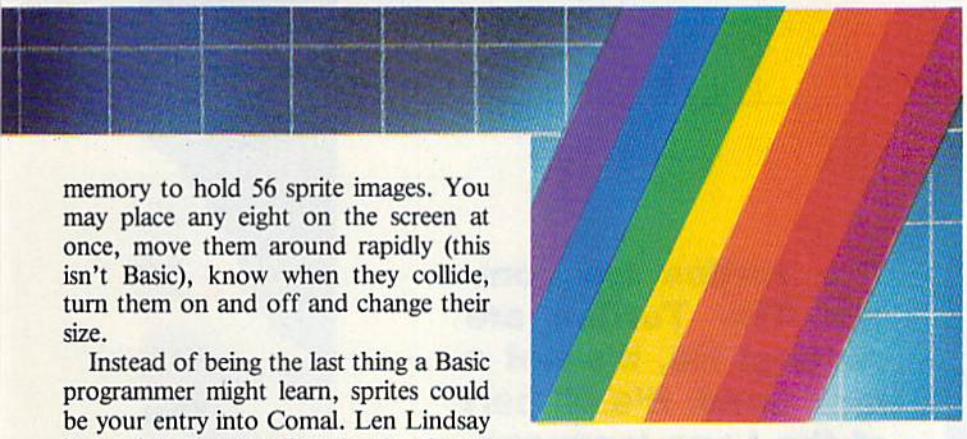
Comal Resources

The Comal User's Group, headed by Len Lindsay, is the best source of Comal literature, program disks and help, but textbooks are also available from Reston Publishing. Your local user's group also may have a Comal special interest group.

The 0.14 language is not public domain, but may be copied for your use and placed in your local user's group library. For a complete list of Comal resources, send a SASE to: Comal User's Group, USA, Ltd.; 5501 Groveland Terrace; Madison, WI 53716; telephone 608-222-4432.

Where Is Comal Headed?

The 0.14 version was always intended as a learning language, not a powerful development system. The next version of Comal, the 64K cartridge version 2.0, was released in small quantities in Denmark last spring. Commodore is due to release 2.0 in America at the end of the year.



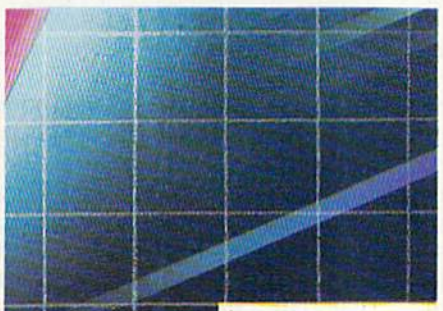
memory to hold 56 sprite images. You may place any eight on the screen at once, move them around rapidly (this isn't Basic), know when they collide, turn them on and off and change their size.

Instead of being the last thing a Basic programmer might learn, sprites could be your entry into Comal. Len Lindsay has written an excellent book, *Comal Graphics*, that takes you by the hand and walks you through every aspect of sprite definition and control. The book, written in the style of his *Comal Handbook*, assumes you have no programming skills to call on before you enter the uncharted wilderness of sprites.

When PET Comal 1.02 was converted to the C-64, the UniComal group lifted the best part of Logo and put it into Comal: turtle graphics. Under Comal, the turtle is a small triangle of light, placed on the built-in high-resolution screen. The keywords for moving the turtle are the same as, or slight variations of, the equivalent Logo commands.

The Comal turtle is a sprite that may be hidden or shown. Logo programmers will feel right at home in Comal and will be amazed at the speed of the turtle. It's substantially faster than Logo's turtle and may be mixed with sprites.

The Comal high-resolution screen is instantly available to draw on. One keyword, SETGRAPHIC, gives you access to every graphics function of Logo, the



I have one of the handful of Comal cartridges that have emigrated to the United States. I assure you that this version is the superpowerful program-development system that version 0.14 was not. I've dared predictions in print before, so let's try it again. The Comal cartridge will dig Basic's grave. R

Address all author correspondence to Colin Thompson, c/o BASF Systems Corp., 1307 Colorado Ave., Santa Monica, CA 90404.

LOGO

The Turtles are coming! The Turtles are coming! No, it's not a rock band. It's all part of the Logo language, in which turtles follow directions and teach you about computers.

By Amee Eisenberg

The Turtle is part of a computer language called Logo. Logo, designed by Seymour Papert in the Artificial Intelligence Lab at Massachusetts Institute of Technology, is a language that encourages learning through discovery.

Logo is easy to master, yet many of its implementations are subtle enough to encourage the creation of complex programs. Logo teaches you to think, yet the task of programming the Turtle is so engaging that most people find that the thinking part sort of creeps up on them.

Unlike Basic, which forces you to program in a series of mathematical algorithms, Logo allows you to create language, to create the tools to fit the occasion. Designed in keeping with current cognitive theory, Logo can be learned and used the way human beings naturally learn and use language.

Learning a Language

We learn about the world by manipulating our environment, child psychologist Jean Piaget theorized. We learn about language by manipulating words, and we acquire our language skills in stages. Infants babble, learn words and then begin combining those words into baby talk—two- or three-word sentences that child psychology labels telegraphic communication.

"Katie bottle" may not be eloquent,

yet Katie's parents will have no trouble understanding that Katie wants her bottle. For her part, Katie has learned that in a given situation—thirst—speaking the words Katie and bottle together yields a positive, concrete result—Mom or Dad gives her the bottle.

Baby talk empowers the child with an ability to use abstract concepts (language) to build concrete results. Further, as children learn to successfully communicate, they are also learning the underlying grammatical structures of the language. Having acquired those structures, they can then recreate the language when they are confronted with a new situation.

Building from old words when facing a new situation is a natural response. We have named our passenger-carrying space vehicles space ships—recalling the times when sailing ships carried explorers into the vastness of the then uncharted seas. Our grandparents, when confronted with the first automobiles, named them horseless carriages—a constant reminder of the way those strange contraptions deviated from the norm.

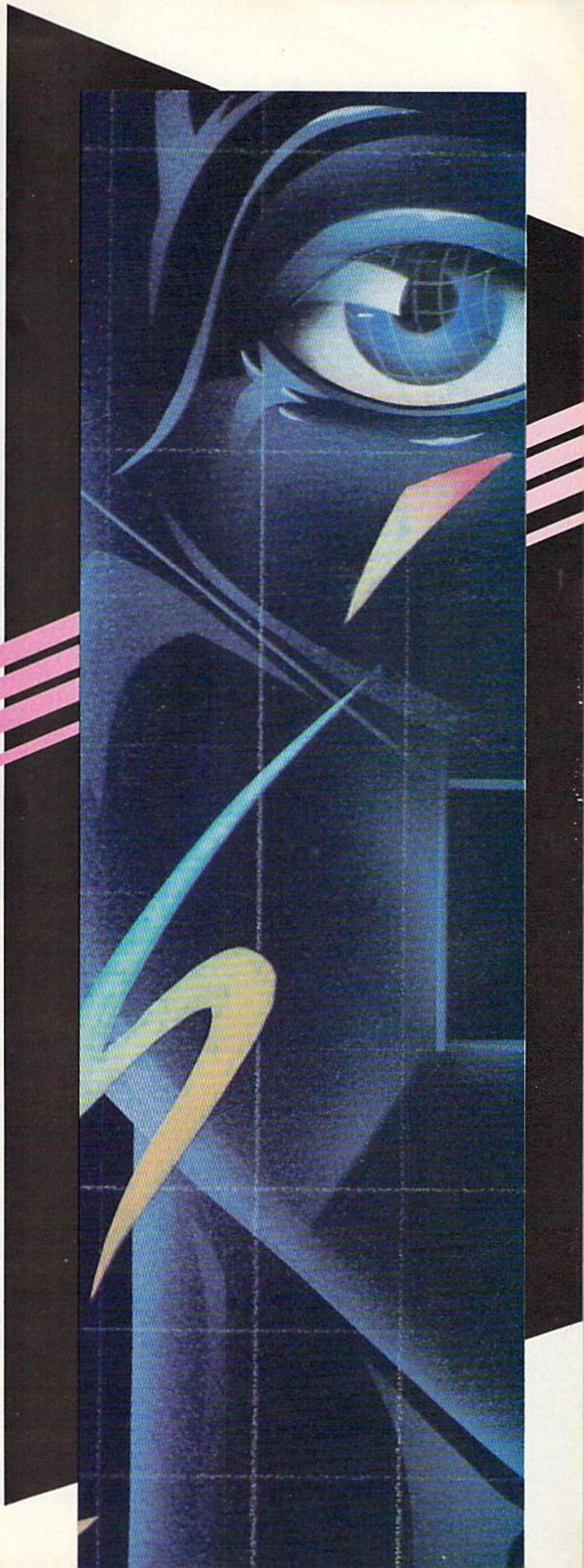
Turtle Graphics is Logo's baby talk. It is the way children (and adults) acquire their knowledge of Logo. Turtle Graphics (and subsequently, all of Logo) incorporates the natural language-learning sequence. Using combinations of primitives (Logo's basic command vocabulary), you can tell the turtle to perform concrete manipulations.

As originated in MIT's Artificial Intelligence Lab, the turtle was a physical object—a dome-shaped robot, with independently driven wheels, that carried a pen. The independent wheels allowed the turtle to turn in place, and the pen allowed the turtle to mark a trail as it moved.

The turtle executed simple commands. You could combine Forward and Right Turn to make the turtle draw triangles and squares. However, running robots around the lab may prove cognitive theory, but it doesn't do much for your Commodore 64.

To bring Logo to the home computer, the turtle had to evolve. Today, the turtle is most commonly a triangular cursor that moves around the video display screen.

Despite being reduced to a TV pic-



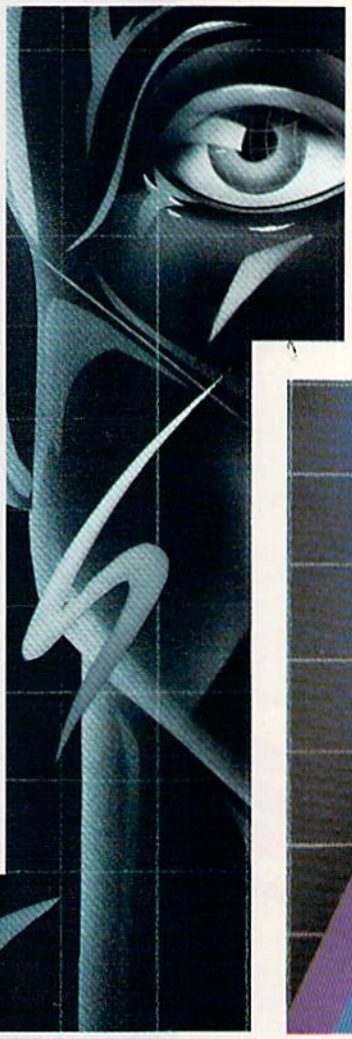
ture, the turtle still retains elements of physicality and pliability. The directions you give to the turtle are concrete: Forward, Left Turn. If a certain set of instructions don't yield the desired results, you need only get out of your chair and "play turtle" (that is, follow the directions yourself) to debug the program.

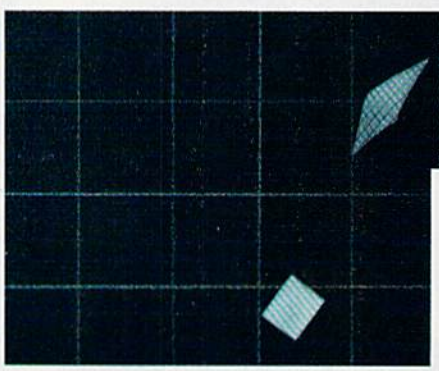
Concrete Abstractions

Primitive commands like Forward 10 and Right Turn 90 move the turtle forward ten turtle steps and turn it 90 degrees. If the turtle (who always carries a pen) has its pen down, it draws a line to mark its path.

The turtle draws pictures by following your instructions. It executes these instructions in Immediate mode (as soon as you enter them) or you can make it wait. In the latter instance, you chain together a list of instructions, to form a procedure. Once defined, procedures can be chained together to form other, more complicated procedures.

For example, you can draw a triangle using two primitives: Forward (abbreviated FD) and Right Turn (RT). In Immediate mode, you tell the turtle to go forward 100 steps, then turn right 120 degrees. Then you repeat these instructions twice more.





Or, you can teach the turtle to "triangle." The procedure looks like this:

```
TO TRIANGLE
FD 100 RT 120
FD 100 RT 120
FD 100 RT 120
END
```

Now, to draw a triangle, all you do is type TRIANGLE and the turtle draws a triangle.

What's more, you can use the word triangle in other procedures, and the turtle will understand. For instance, to draw an iron cross, you can use this procedure:

```
TO CROSS
TRIANGLE RT 90
TRIANGLE RT 90
TRIANGLE RT 90
TRIANGLE RT 90
END
```

Thus, Logo allows you to build on your experience.

As you become a more advanced user, you'll learn that Logo contains the primitive Repeat. Now you can create a triangle in one statement. For example:

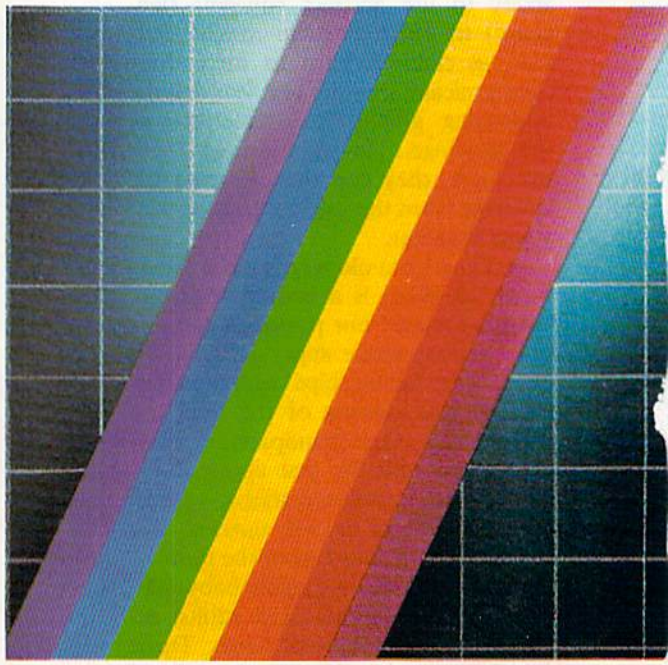
```
TO TRIANGLE
REPEAT 3 [FD 100 RT 120]
END
```

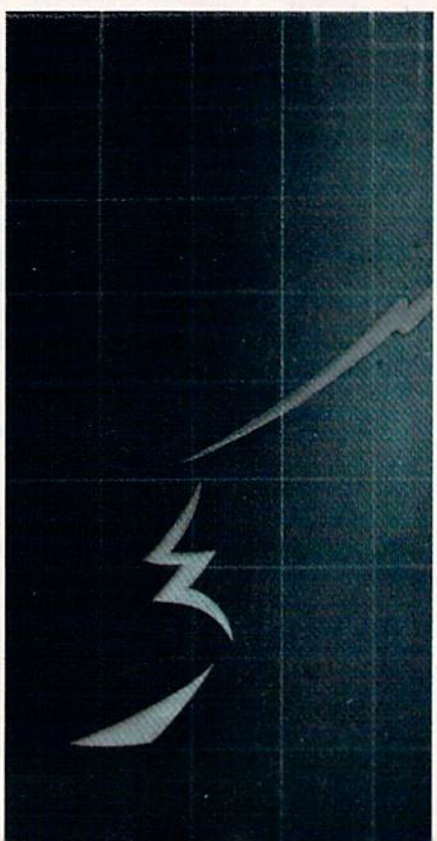
Of course, something's happening here that goes beyond pretty pictures—you're learning Logo's underlying grammatical rules. From the turtle-graphics syntax, you can generalize to all Logo syntax. For example, things outside brackets act upon things inside brackets.

Just as important, the procedures you create become part of your environment, allowing you to build complex procedures from simple ones. Triangle is the basis for Cross. The more vocabulary (procedures) you have, the more easily you can communicate complex ideas.

A Thoughtful Idea

Logo was developed for children. It was developed to encourage children to work with computers by allowing them to meet with success. (And that's not





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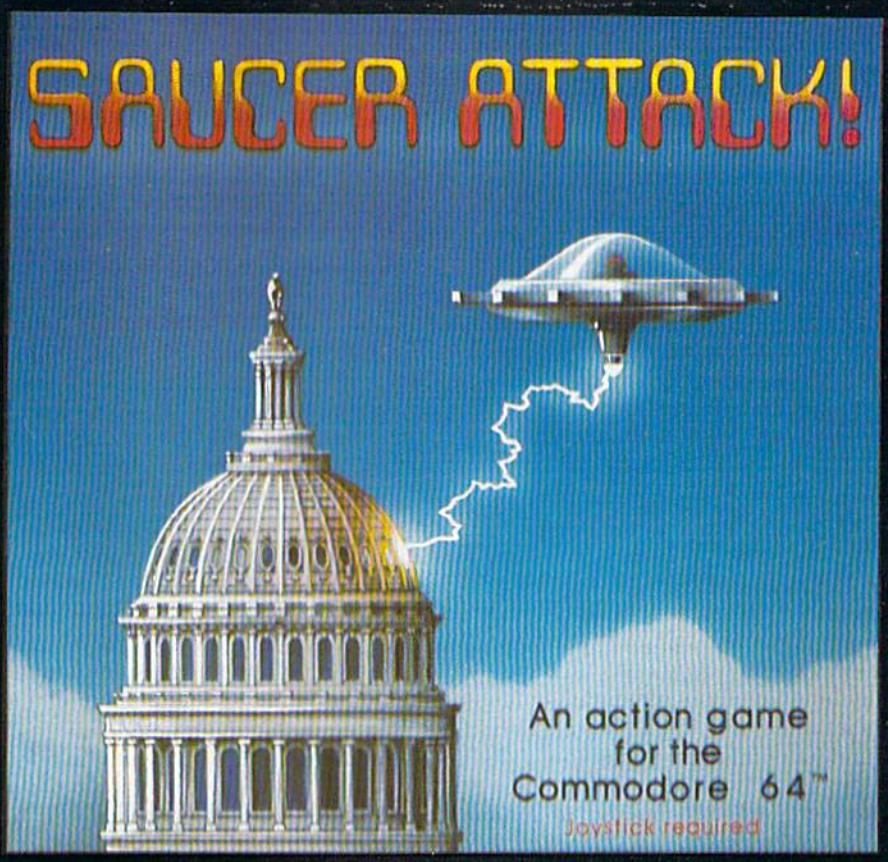

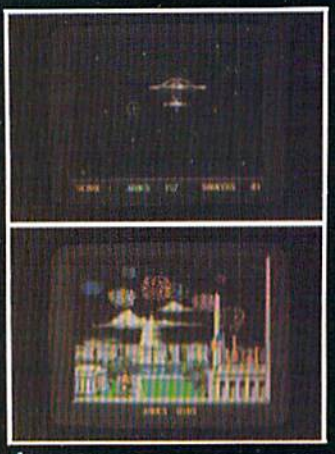

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such a childish idea.) There's no "wrong" way to do something in Logo. You begin with an idea—I want to draw a triangle, for instance—then you experiment, moving the turtle around until the picture on the screen fulfills your idea.

Turtle graphics are important, but they're only the beginning of Logo. A subset of Lisp (the list-processing language), Logo lets you do more than draw. Logo does what is known as symbol processing; that is, operating on ideas as if they were physical objects. If this seems esoteric, stop and think about how you think.

Take the idea of Boat. There are many kinds and shapes of boats, yet somehow you recognize them, in all their guises, as belonging to that same class—Boat. How do you do this? You process symbols. Boat has certain properties attached to it; for instance, boats float on water and carry things.

Sailboats are a kind of Boat. They have all the properties that boats have, plus sails. Thus, all sailboats are boats, but not all boats are sailboats.

This is simple enough logic to human beings, yet it becomes impossibly complex when you try to create a Basic program that will know about boats. People process symbols naturally. We attach properties to objects, then judge whether other things also fit into the same class.

In Logo, you can make a list of Boat's properties, then operate on those properties and evaluate how other objects relate to Boat. Logo is a language that lets you phrase questions in very human ways; no longer are you trapped into algebraic thinking. If you're trying to create a program that can choose the better course of action in a given situation, Logo gives you the tools with which such problems can be solved.

Beyond that, Logo gives you an approach to solving problems, whether on the computer or off, that is invaluable. It teaches both creative problem solving and problem analysis. Papert claims that Logo is "culturally resonant." That is, Logo skills apply to other tasks you'll confront.

Logo allows you to approach computers from either an architectural or an artistic direction. You may either blueprint your program or create it as the spirit moves. This means that a lot of people who might otherwise meet much frustration in dealing with computers can find a rewarding experience.

That alone might be the best reason your computer should speak Logo. The next time someone asks, "But what do you *do* with your computer!", tell him or her "I think with it. You can, too." R

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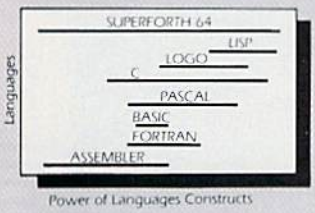

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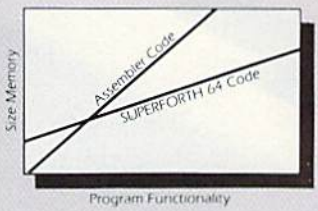

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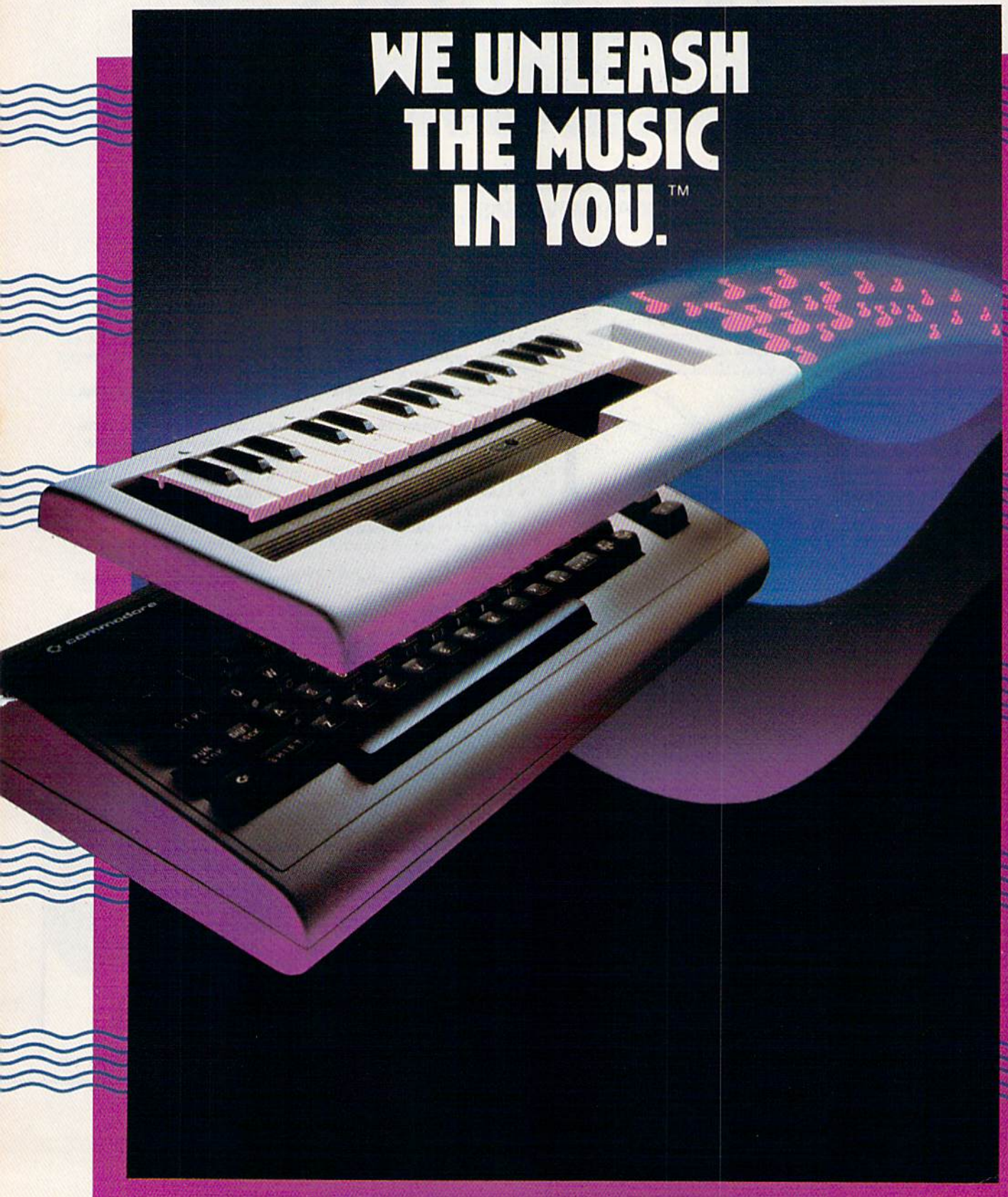
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PASCAL

Pascal is a structured language that requires logical thought and planning on the part of the programmer. No wonder it was named after a famous mathematician.

By Margaret Morabito
***RUN*'s Assistant Technical Editor**

If you are an owner of a C-64, you've probably discovered that your computer is much more than just a game machine. The tremendous growth in serious home, business and educational applications is readily seen in the number of programming languages and Basic enhancers now available for the Commodore.

One of the most popular languages chosen for production is Pascal, of which there are now five different versions available for the 64. (See Table 1 for names and addresses.)

Pascal is popular for several reasons. Many of you have heard, I'm sure, that Pascal is the language used for the College Entrance Examination Board Advanced Placement test in computer science. Also, Pascal is one of the most widely used introductory programming languages in colleges and universities world-wide and is the language upon which the Department of Defense has based its own computer language, ADA, for use within government installations. This means that at least in academic circles or in government service you would probably be expected to become familiar with Pascal. This is all well and good, but why have the schools and the government focused in on this language?

Clarity and Speed

If you study Pascal, you'll quickly discover its advantages. First, it is easy to decipher, since it has very clear internal documentation. A newcomer can actually look at a Pascal program and get the jist of it just from its vocabulary; an artisan of programming can quickly see exactly what's going on and where.

To top this off, it's a fast-running language. These factors together give you a clue as to why industry tries to hire people familiar with structured programming languages—it saves time and it saves money.

Pascal was first developed by Niklaus Wirth, from the Engineering University of Zurich, Switzerland, in the early 1970s. Wirth wanted to use the language for teaching computer programming. His aim was to teach an understandable, systematic approach to problem-solving, and he hoped that Pascal would be an improvement over some of the earlier languages invented for this purpose, such as Cobol, Fortran and Basic.

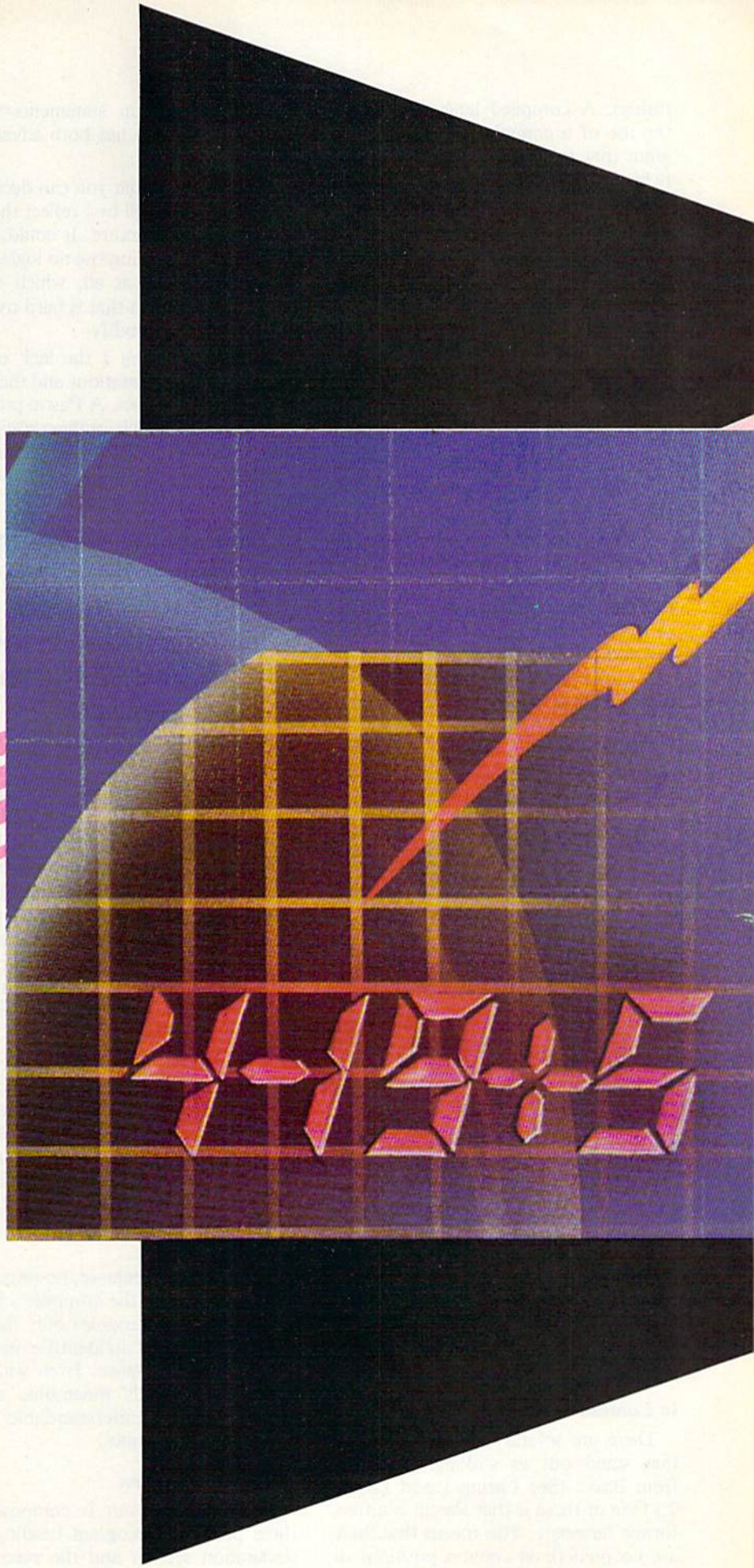
Pascal caught on and its growth has been steady, but not just in academic circles. It is good for handling large amounts of complex data, and therefore is often used in business and industry. Various versions can run on some 30 different operating systems.

You might wonder why Pascal, if it's such a good language for learning programming, isn't as well-known as Basic. There are a couple of reasons. First of all, Basic was one of the first languages, back in the late 1960s, available to micro- and minicomputers. When manufacturers started producing home computers, Basic was the proven standard; Pascal was a newcomer.

Obviously, it wasn't a hard decision to install the better-known Basic, rather than the academic experiment, Pascal. Also, Microsoft was quickly becoming the king in software production, and its prime concern was Basic.

A Close Look

Pascal, named for Blaise Pascal, the 17th century French philosopher and mathematician, is a compiled language. It can handle numeric and textual data and is used in areas such as typesetting, editorial operations, and CAD/CAM (computer-aided design and manufac-

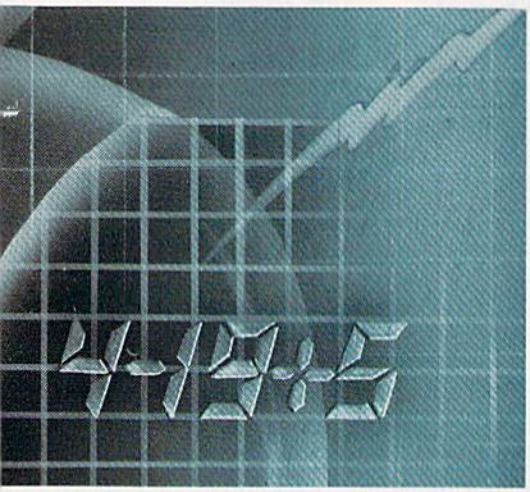


turing). A compiled language requires the use of a compiler, which is a program that takes your written program (which vaguely resembles English) and translates it into a language your computer can readily understand.

A compiled language has its strengths and weaknesses. On one hand, the final program is very fast-running. On the other, it takes many more statements to create the program in the first place. Then again, it is less apt to have bugs, because you must do so much planning and testing before the program gets to the compiler stage. Most compilers simply will not compile programs that contain errors. Unfortunately, a compiled language uses more memory.

Pascal is a high-level language that adheres strictly to structured programming and top-down design. This means that the program is designed in a series of levels, each of which you must write, test and debug before proceeding to the next lower level. This is beneficial because, if a bug does occur, you can easily isolate and fix it.

You handle the general procedures at the top and develop the more mechanical implementations at the lower levels.



Therefore, it's important that you understand all the angles of a problem's solution before starting to write the program. An underlying goal of this design is to save time and money on programming costs.

In Contrast to Basic

There are several elements in Pascal that stand out as strikingly different from Basic. (See Listing 1 and Listing 2.) One of these is that Pascal is a free-format language. This means that there are no predefined column positions or line boundaries on statements within the program. This has both advantages and disadvantages.

The benefit is that you can decide on the format that will best reflect the program's logical structure. It could, however, allow you to impose no logical formatting structure at all, which would result in a program that is hard to read, understand and modify.

Notice in Listing 1 the lack of line numbers, the indentations and the spacing between the lines. A Pascal program resembles the rough outline you probably wrote for your English essays.

A Pascal program resembles the rough outline you probably wrote for your English essays.

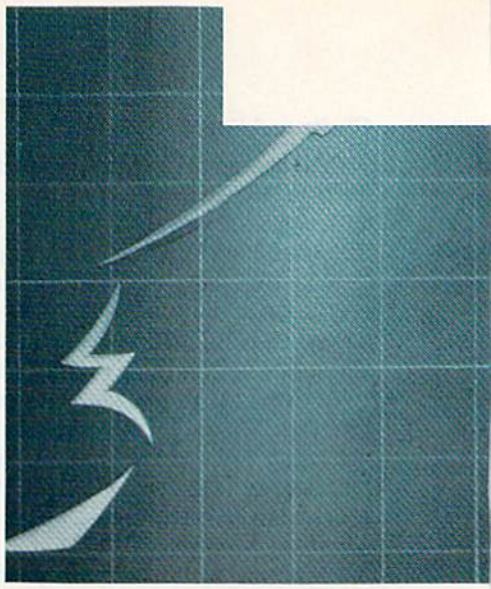
A second major difference is in the wording. Every Pascal program contains keywords and identifiers, corresponding to Basic's reserved words and variable names. Pascal, like Fortran and PL/1, utilizes mnemonic names (see Table 2). A mnemonic is a memory device. As applied in computer programming, a mnemonic name is a word or abbreviation that helps you remember by association.

If you see the word 'sum', you think of addition; 'totl' suggests total; 'soc sec' reminds you of social security. In Pascal, identifiers may be composed of as many characters as you feel necessary. The only restriction is that identifiers must have a letter as the first character, followed by any number of letters or digits.

As a compiled language, however, Pascal is affected by the compiler's limits, which generally recognize only the first eight characters of an identifier in order to save memory space. Even with this limitation, Pascal's mnemonic names are far more understandable than Basic's variable names.

Three-Part Program

A Pascal program is composed of three parts: the program heading, the declaration section and the executable



section. The heading names the program and identifies the way in which data will be treated. This usually is in the form of input from the keyboard and output to the monitor.

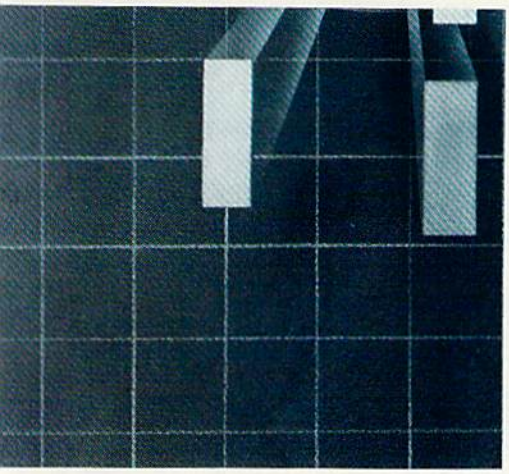
In the declaration section, you describe labels, constants, variable types, procedures and functions that will be referred to throughout the executable section. Procedures and functions, powerful tools for the Pascal programmer, help in the development of fast, easy-to-understand programs. They allow you to use the same group of programming statements in several places within a program.

Procedures and functions are actually subprograms that can be called from lower levels. The structured approach of Pascal is very noticeable here. Before the program can proceed to the lower levels of execution, everything to be used by those lower levels must be written, declared and tested.

The third part, the executable section, does the work that was defined in the previous two parts. This part is framed by the reserved words BEGIN and END. Input and output commands are designated by READ and WRITE.

Pascal also provides ample opportunity for internal documentation. Comments can be inserted between pairs of brackets or parentheses framed with asterisks (*comment*). These will not affect the program's execution. This is one element that strongly enhances Pascal's claim to easy maintenance.

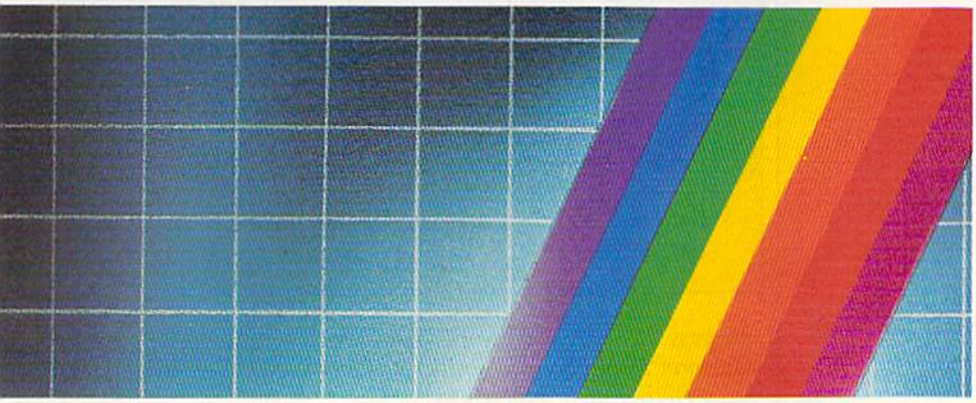
Pascal offers three kinds of looping features in the executable section: WHILE...; REPEAT...UNTIL; and FOR...DO. Also, Pascal allows for decision making. The IF...THEN... ELSE control structure is used to determine whether or not a single statement will be executed. It also is used to select



the specific elements of Pascal, but a detailed analysis can't fit into a few pages. If you're seriously interested in learning more about this language, I recommend that you do some reading before you go out and buy a Pascal compiler.

If you do decide to purchase a Pascal compiler, you should be aware that there are different versions available for the C-64, just as there are machine-specific versions of Basic. They all have their idiosyncracies. Many versions claim to be subsets of the standard Pascal, but what is that, and does it really make a difference?

The first standard is Niklaus Wirth's version, and you can read up on that by getting Wirth and Jensen's original definition of the language (*Pascal User Manual and Report*, 1974). The next standard often referred to is UCSD Pascal, which was developed at the University of California, San Diego. This is considered the standard in this country and is an extension of Wirth's first Pascal. To complicate matters, a new international standard for Pascal, the ISO (International Standards Organization) Standard, has been developed in an effort to deal with the different versions and subsets of Pascal.



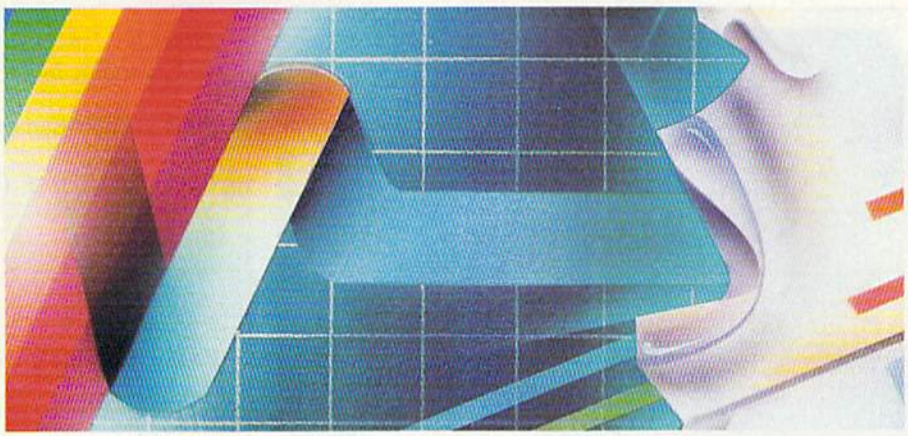
Most versions of Pascal are based on Wirth's original. I suggest that a newcomer to the language try to find a software company that provides a good thick manual with the Pascal disk. (By the way, you'll need a disk drive.) One company that gives you this is Oxford. They provide an 84-page user's manual that actually tells you what to do with your Pascal power and gives you small programs you can sit down and type in.

Look around before you buy. Try to get a version that will teach you something. Even if it's not the first or second or international standard, it will get you up and running on Pascal. R

between two statements by means of logical evaluation. The simpler IF... THEN is also acceptable. The ability to nest these expressions is another useful feature.

Lastly, the GOTO statement, which allows execution of a jump to another location, is accepted by most Pascal compilers. However, Pascal programmers are advised not to use GOTO. The main problem is that a program can quickly become too complicated and hard to understand. This tends to undermine the principles of modular design.

There is much more detail to offer on



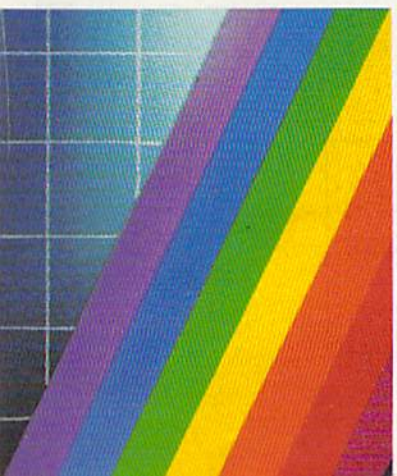


Table 1. Five versions of Pascal available for the C-64.

Oxford Pascal
Oxford Computer Systems, Ltd.
Hensington Road
Woodstock, Oxford OX71JR
England

G-Pascal
Gambit Games
PO Box 124
Ivanhoe, Victoria 3079
Australia

Zoom Pascal
Abacus Software
PO Box 7211
Grand Rapids, MI 49510

KMMM Pascal
A B Computers
252 Bethlehem Pike
Kolmar, PA 18915

Pascal Compiler
Limbic Systems, Inc.
560 San Antonio Road,

Listing 1. A Pascal program asking for user input of two numbers to be added and subtracted.

```
PROGRAM sumanddiff(input,output);

VAR

    num1,num2 : integer;
    sum,diff : integer;

BEGIN
    page(output);
    writeln;
    writeln;
    writeln('This program displays the sum and');
    writeln('difference of two integers');
    writeln;
    writeln;
    write('Enter the first number please--');
    readln(num1);
    writeln;
    write('Enter the second number--');
    readln(num2);
    writeln;
    writeln;
    sum := num1 + num2;
    writeln('The sum of ',num1,' and ',num2,' is ',sum);
    diff := num1 - num2;
    writeln('The difference between them is ',diff)
END.
```

Listing 2. The Basic counterpart of the Pascal program in Listing 1.

```
10 REM PROGRAM TO CALCULATE SUM AND
   DIFF OF TWO NUMBERS
20 REM USING USER INPUT
30 PRINT"{CLR/HOME}"
40 PRINT
50 PRINT
60 PRINT"This program displays the sum and"
70 PRINT"difference of two integers"
80 PRINT:PRINT
90 PRINT"Enter the first number please--"
100 INPUT N1
110 PRINT
120 PRINT"Enter the second number--"
130 INPUT N2
140 PRINT:PRINT
150 S=N1+N2
160 PRINT"The sum of ";N1;" and ";N2;" is ";S
170 D=N1-N2
180 PRINT"The difference between them is ";D
190 END
```

Address all author correspondence to Margaret Morabito, c/o RUN, *80 Pine St., Peterborough, NH 03458.*

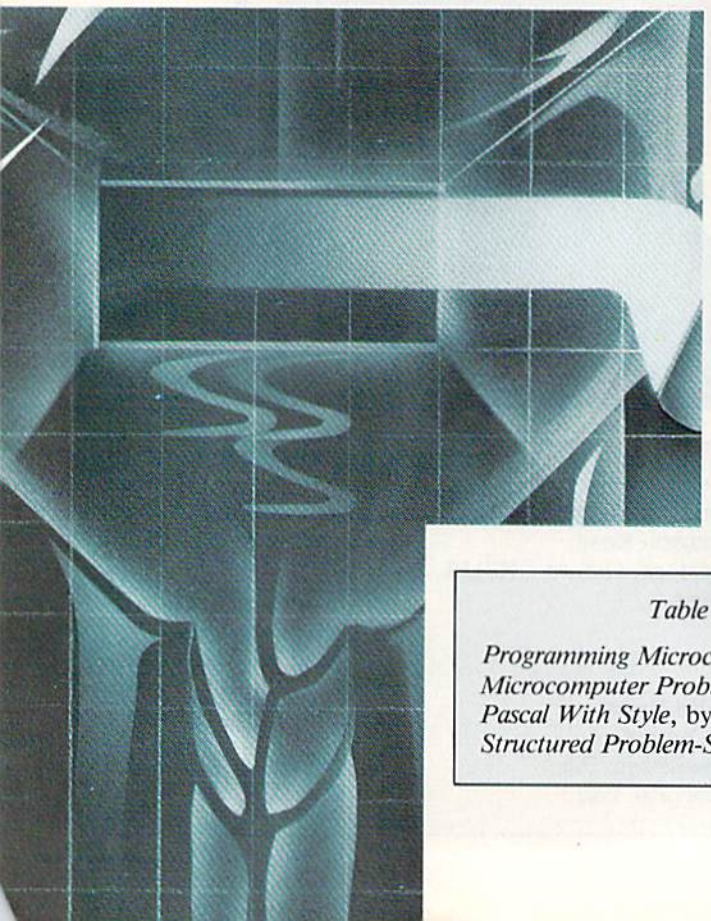


Table 2. Pascal's use of mnemonic names aids in quick understanding of program variables.

Basic variable names:

```
10 G = (W*H) + (O*X)
20 T = R1 * G
30 S = S1 * G
40 P = G - T - S
```

Pascal Mnemonic names:

```
GROSSPAY     = (WAGE * HOURS) + (OVERTIME*
               EXTRAHOURS);
TAX          = TAXRATE * GROSSPAY;
SOCSECURITY  = SOCSECRATE * GROSSPAY;
NETPAY       = GROSSPAY - TAX - SOCSECURITY;
```

Table 3. Recommended reading.

Programming Microcomputers With Pascal, by M.D. Beer
Microcomputer Problem-Solving Using Pascal, by K.L. Bowles
Pascal With Style, by Ledgard, Hueras and Nagin
Structured Problem-Solving With Pascal, by L. Mazlack

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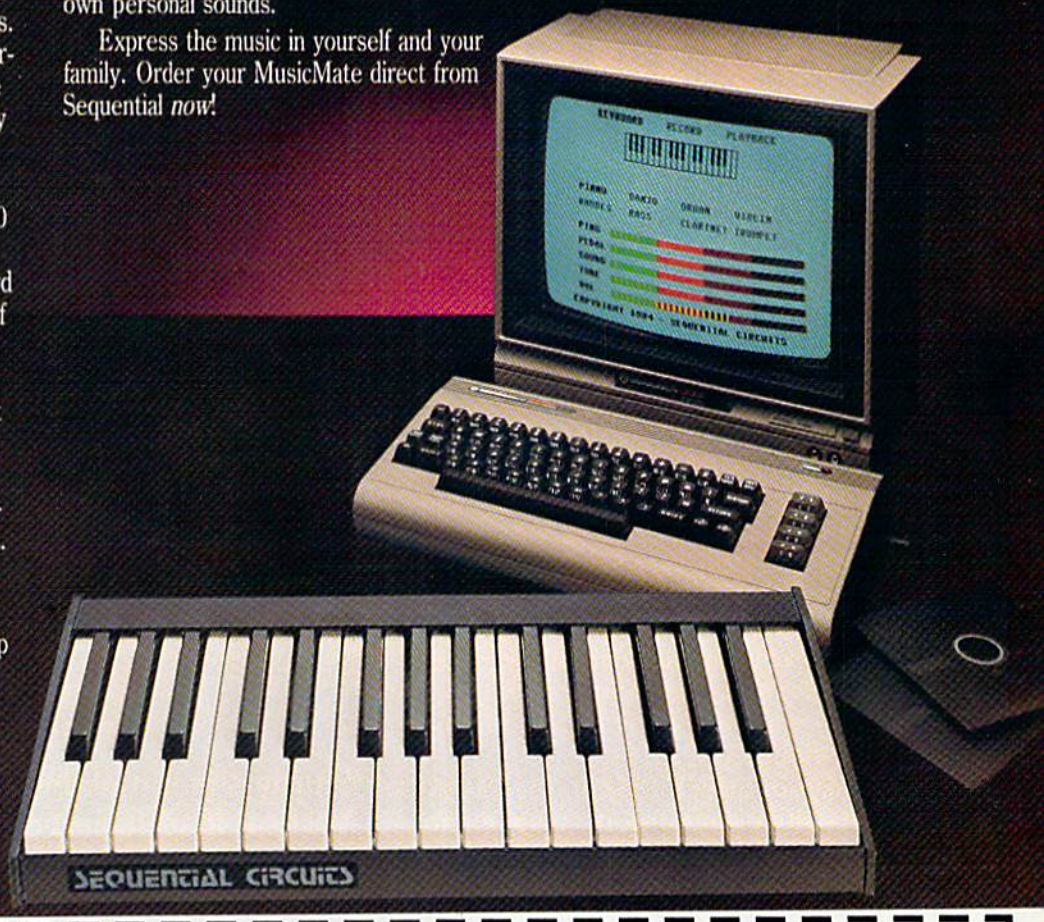

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PARALLEL BUS	YES, for enhanced speed, IEEE for Commodore compatibility.
DAISYCHAIN	Up to 4 drives
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Sequential	168656 bytes per diskette
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Directory Entries	144 per diskette
Blocks	683 total per diskette 664 available per diskette
Tracks	35 per diskette
Sectors	17 to 21 per track
Bytes	256 per sector
Diskettes	Standard 5¼", single sided single density

*NOTE: The SD-2 contains two disk drive mechanisms and can therefore handle two times the above capacities (one for each diskette).

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Commodore Compatible Serial Bus Interface
Commodore Compatible IEEE Parallel Bus Interface

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PILOT

Fasten your seatbelts and prepare for take-off. This article will fly you into the friendly skies of the Pilot language—without flight delay, turbulence or lost luggage.

By James Llanos

I have been using Pilot more than any other programming language, and find that it is unknown or overlooked by many people. Just as in any language, there are many positive and negative points to Pilot. These vary depending on how you want to use the language.

Pilot is described as an Interpretive Computer Assisted Instructional (CAI) language, designed for people with educational needs. The Commodore version of Pilot allows programs written in common Pilot to run on the C-64 without any conversions. Imagine being able to take a program written in Pilot, enter and run it without having to change the formats at all! Programs written in Basic usually require changes, because the words used for tabbing, spacing and clearing the screen differ depending on the machine and the version of Basic within each machine.

The Commodore version also has features that are not available for other computers, such as the sound and graphics commands, which were developed to allow the Commodore user a more complete ability to use features of the 64.

Pilot's Ups and Downs

One distinct disadvantage of the Commodore Pilot is its inability to use the printer directly. I have found, how-

ever, that I can use Pilot commands to create a disk file that can then be accessed by a Basic routine to print on the printer. Since I use a 1525 printer, I create, whenever possible, a 60-position record that I can just read and dump with a straightforward dump routine.

The disk routine in Pilot is geared mainly for individual record keeping, but can be used in other ways with a little thought. Another option in printing would be to use the Z: option, which is a call to execute a machine language routine. I haven't tried this yet, but will do so in the near future.

Pilot's ability to define new characters and sprites for your computer is an exceptional plus. You simply define the character (or sprite) in a line-by-line format, using either an x or . to signify an on or off bit. I really like this feature, since you can create images on the screen without having to convert the information into decimal form and then Poke it here and there.

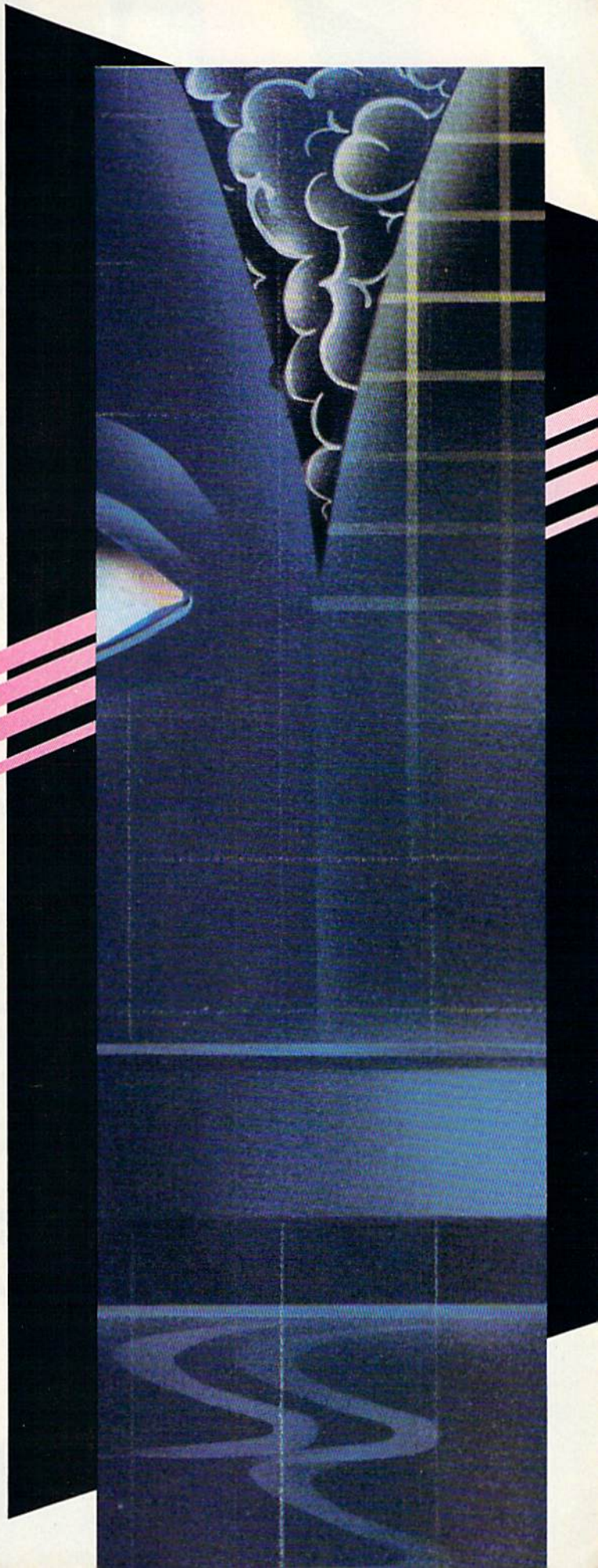
On the negative side, Pilot supports only up to about 400 lines of programming at one time. Those of you who run one section of a program and wish to run more must use the L: command, which links the present program to another that you can load and run. When you're finished with the second program, you use the L: command to relink to the original program. As to Commodore Pilot's sound commands, they cover all the normal range of uses as in Basic, and are actually easier to use.

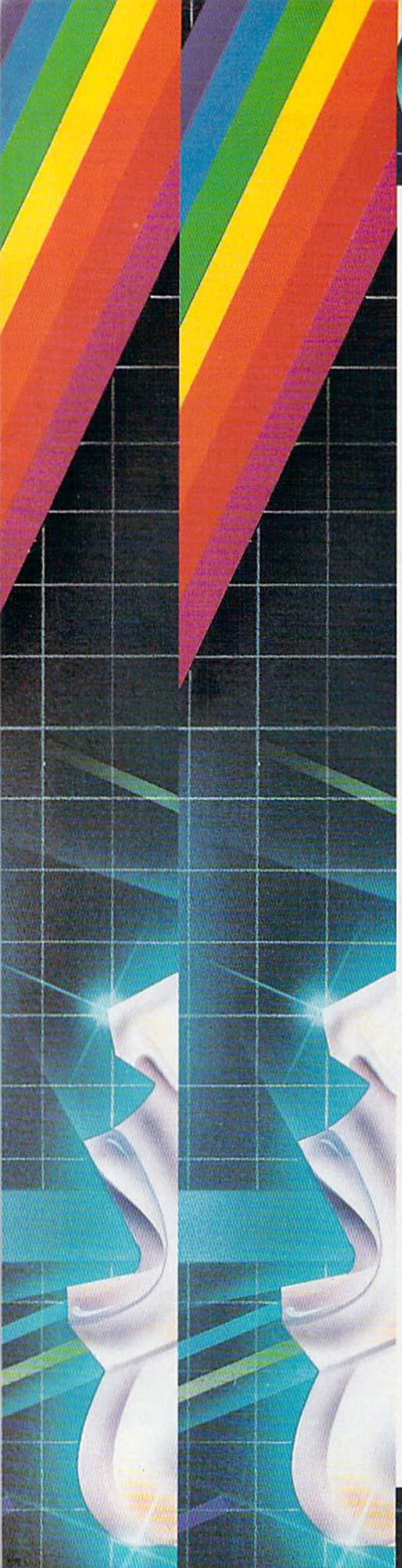
A minor drawback is that the Commodore version of Pilot doesn't have a joystick ability. You must scan the keyboard using a Pilot KEY(0) command—a chore you can live with as long as you don't try to develop something in the line of arcade games.

All in all, I still find the Pilot language impressive. It offers an easy method of developing programs by simply responding to the computer with the keyboard. It allows sound and full, high-resolution graphics. It also allows disk housekeeping and machine language subroutines.

Is Seeing Believing?

How about a small sample of what Pilot programs look like? Pilot does not use line numbers. You enter routines





and subroutines through labels marked with an asterisk.

The following is a small portion of a set of programs that I am developing for stress and depression analysis, and it's relatively straightforward. First, I use the Remark statement to document a little.

```
r:Stress Test—a series of programs to
r:test the stress of living.
r:This is part one—Depression Test
j:start
```

I used the j: (Jump) command to jump to another part of the program called "start." I tend to put all my subroutines at the beginning of a program.

Next I entered a routine called "Askone," which is designed to accept only numbers 0–3 as responses.

```
r:routine to accept response to keep
r:a tally of individual's replies
*askone
t:
t:Please press 0, 1, 2 or 3
*prompt
as:#x
j(x<4):good
t:Please select 0, 1, 2 or 3!
t:try again.
j:prompt
r:valid response—record tally
*good
c:t=t+x
e:
```

You might notice that there are two routines, "Prompt" and "Good," that make up Askone. The Prompt routine waits for a single response to be entered; if it's 0, 1, 2 or 3, it will continue on to the Good routine. Otherwise it informs you that an incorrect answer has been given and returns to the Prompt routine.

The Good routine increments the total counter, t, by the value of x and then returns control to the main program via the e: command.

Next, I found that I would be clearing the screen after each response, so I wrote a routine, called "clear," to do that.

```
r:routine to clear screen and print heading
*clear
ths:
t:
t:Stress test
t:
e:
```

Now I have the basic parts needed for my main program, so I begin at "start."

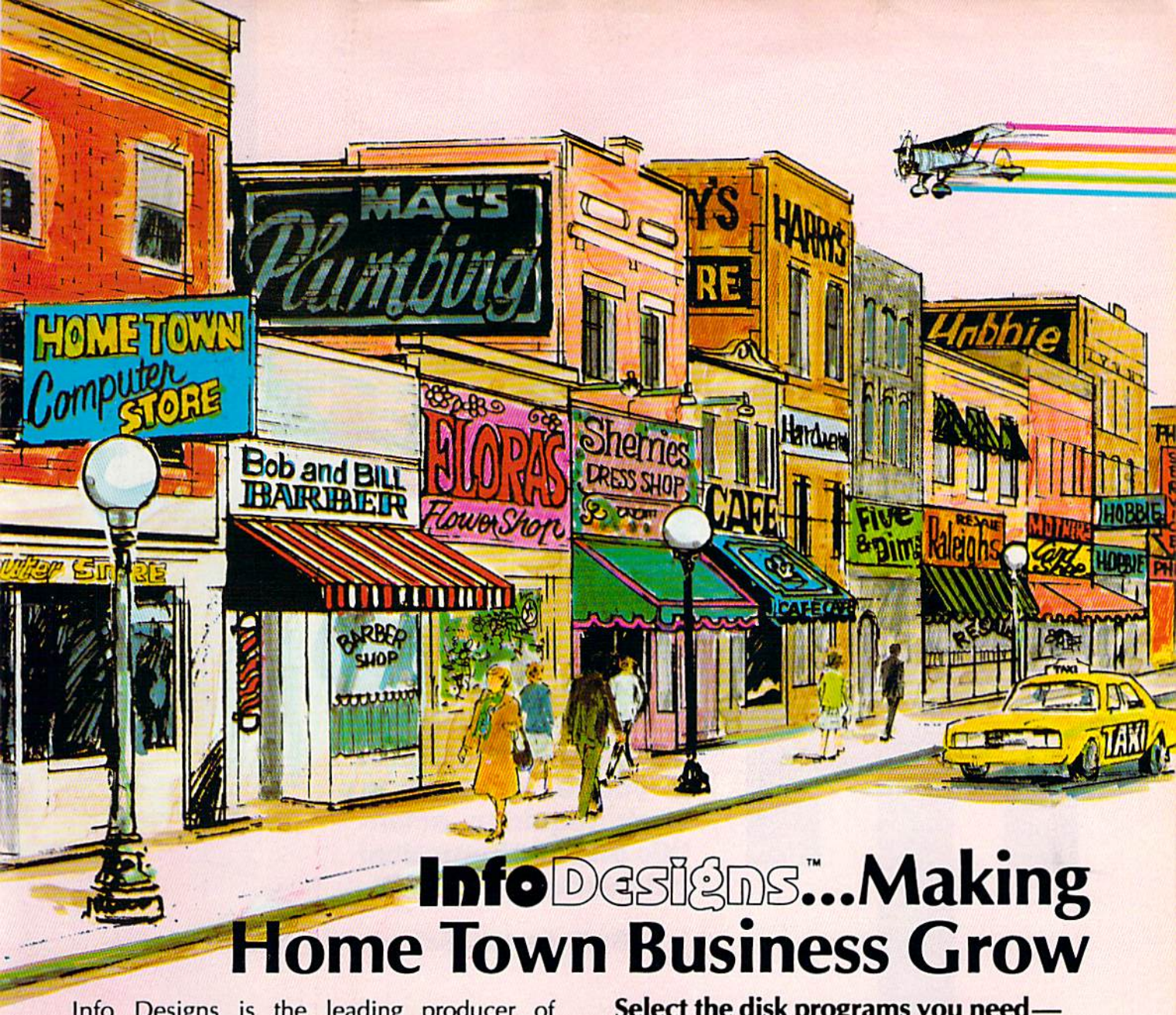
```
*start
u:clear
t:
t:This is a series of tests designed
t:to assist in finding if stress is
:
:
: (instruction section)
:
:
t:
w:35
c:t=0
u:clear
t:
t:0—I do not feel sad
t:1—I feel sad
t:2—I am sad all the time and can't snap out of
it.
t:3—I am so sad or unhappy that I can't stand it.
t:
u:askone
u:clear
```

The program repeats the process of a GOSUB function through the u: (use) routine of Clear, the Display Question and the Askone until the end of the test. At that time, I display the results of the test by interpreting the value of t.

The Commodore version of Pilot comes with a manual that clearly instructs you in normal programming as well as in defining your own characters, creating colorful movable sprites and generating music and sound effects.

While Basic tends somewhat to limit your programming abilities, and machine language is sometimes too complicated for the average home user, Pilot is a good alternative. R

Address all author correspondence to James Llanos, Box 6692, Ketchikan, AK 99901.



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FORTRAN

This programming language is hard to beat if you're involved in work requiring scientific and mathematical calculation.

By Robert W. Baker

The term Fortran is used interchangeably to designate both the Fortran language and the Fortran compiler. The name comes from the words *For*mula *Trans*lation, with Fortran originally designed primarily for scientific and mathematical calculations back in the early 1950s.

The two early versions of Fortran, Fortran I and Fortran II, were designed for one particular IBM computer. Fortran IV was introduced in 1962 and excluded the machine-dependent features of previous versions while adding statements for declaring data types. By 1963, most computer manufacturers were offering some version of Fortran for their systems, and it had become one of the most effective languages for writing scientific and mathematical programs.

Fortran Statements

Fortran programs consist of sequential statements of five basic types: input/output operations, variable and data assignment, program flow control, general specifications and subprogram definition, or linkage.

The first three types direct the computer to perform some operation, like transferring data between memory and an input or output device, or controlling the order in which statements are performed. These statements are all execut-

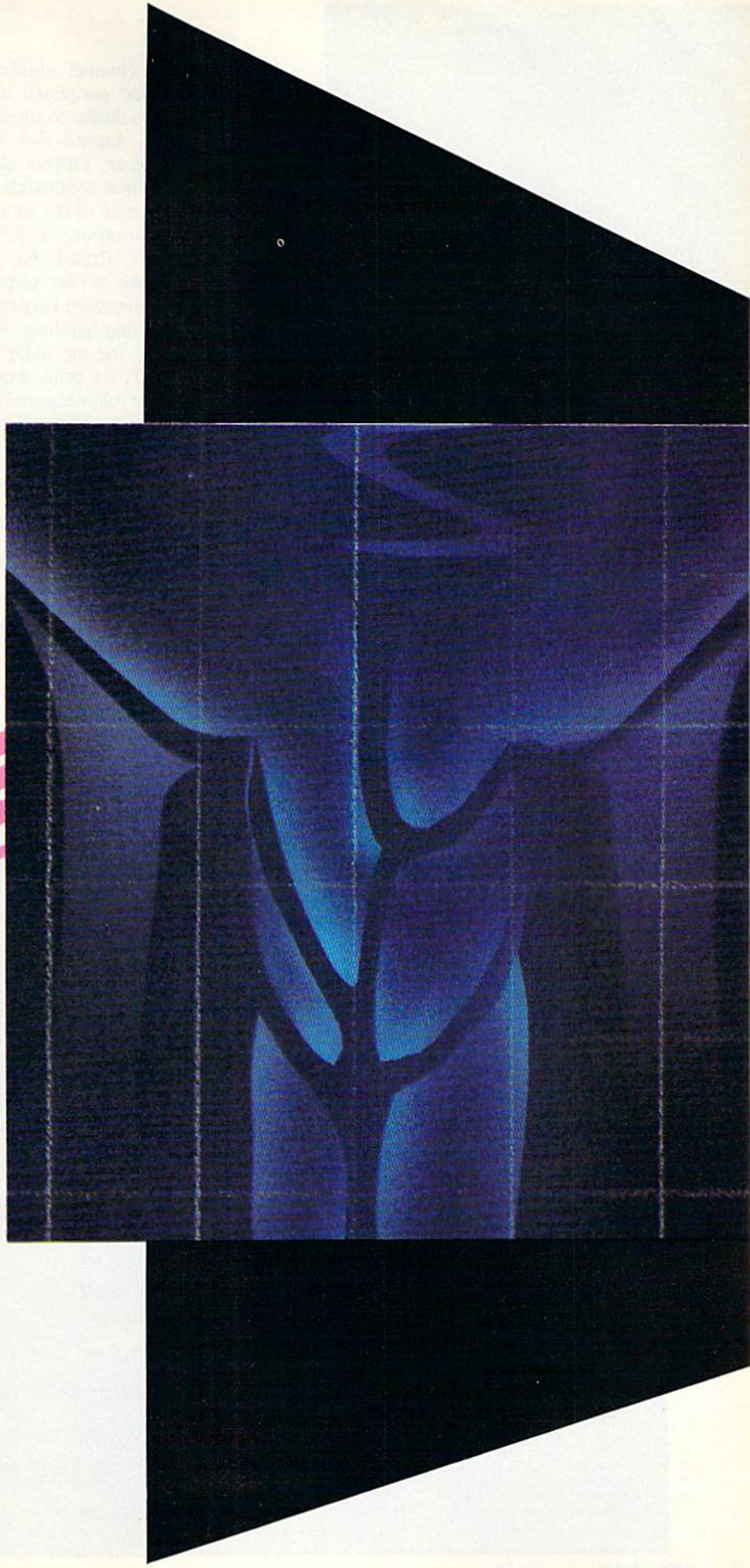
able, and the Fortran compiler translates them into equivalent machine language instructions that are included in the final program generated by the compiler.

Specification statements allow you to pass information to the compiler regarding the arrangement of input and output data, the types of variables used in the program and the allocation of working storage. They are nonexecutable and do not generate instructions in the final program that is generated.

Subprogram statements are nonexecutable but do allow the definition and use of subprograms within the main program.

You can assign line numbers to Fortran statements. If a statement is to be referenced by any other statement, it must have a line number. Unless a control statement directs otherwise, the executable statements are performed in the same sequential order in which they appear in the program.

Actual Fortran statements are similar to those found in other languages and are not difficult to master. The real advantages of Fortran are the typically extensive, predefined subprogram libraries and the ability to perform high-precision computations. Most Fortran versions support integer, real and even complex numbers, in single or double precision.

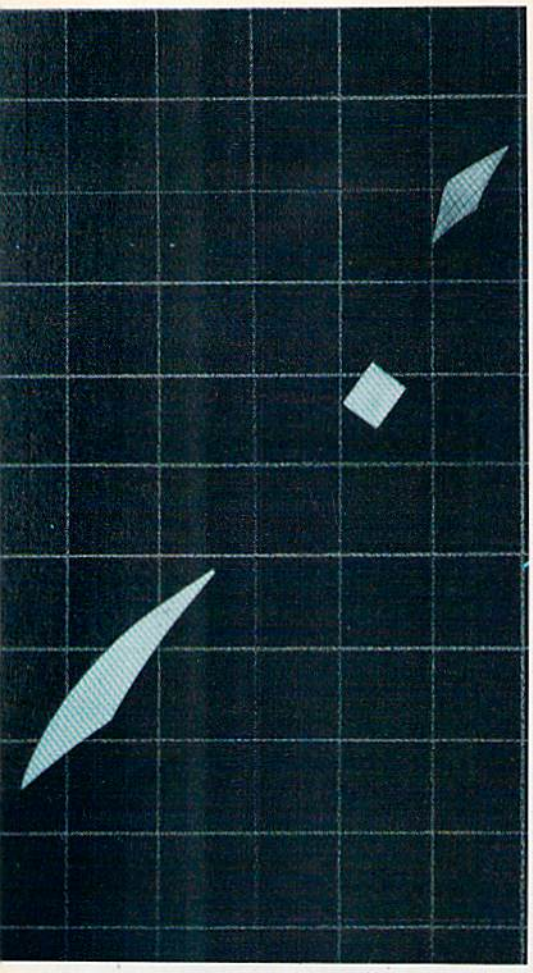


Input and Output

The biggest disadvantages of Fortran are the requirement to fully specify the data formats for input and output, and the lack of good character-string handling. Almost everyone who has had Fortran in school will be sure to remember its Format statements. The following is a short sample of a Fortran IV program that might have been entered on a large IBM computer.

```
C     THIS PROGRAM READS 2 NUMBERS,
C     ADDS THEM TOGETHER AND
      WRITES THE ANSWER
  358 FORMAT (F8.3)
    1 FORMAT (F7.3, F7.3)
      READ (5,1) B, C
      A = B + C
      WRITE (7,358)
      STOP
      END
```

Commands for input and output typ-



ically use device channel numbers to identify the desired peripheral device. These numbers are similar to those used in Basic's Open, Input# and Print# commands. However, Fortran also allows using the Format commands to indicate the exact format of the data fields being input or output, a function similar to Basic's Print-Using statement. Some versions of Fortran provide extensions to the standard language for better character-string handling. Waterloo microFortran, for the older Commodore SuperPET, is a prime example, as illustrated in the following short sample program.

```
character firstname,lastname,fullname
print,"Concatenation of character strings"
loop
   print,"What is your first name?"
   read,firstname
   quitif firstname = "quit"
   print,"What is your last name?"
   read,lastname
   fullname = firstname // " " // lastname
   print,"Your full name is ",fullname
endloop
end
```

When you compare this sample program with the previous Fortran IV sample, you see the wide variation in Fortran versions, especially as implemented on microcomputers.

Today there are many versions of Fortran, including Basic Fortran, Fortran IV, Fortran-77 and so on. Most versions have certain enhancements or omissions from the current language standard. Originally written for mathematical formula translations, Fortran typically has poor string or text handling capabilities and is not very well suited for database applications. Certain micro adaptations have extensions to better handle these areas, because they relax Fortran's otherwise strict coding format requirements. R

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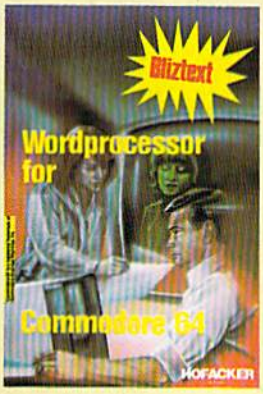

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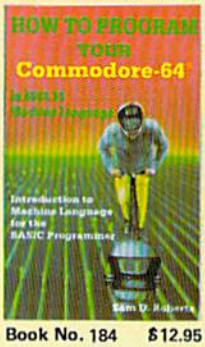

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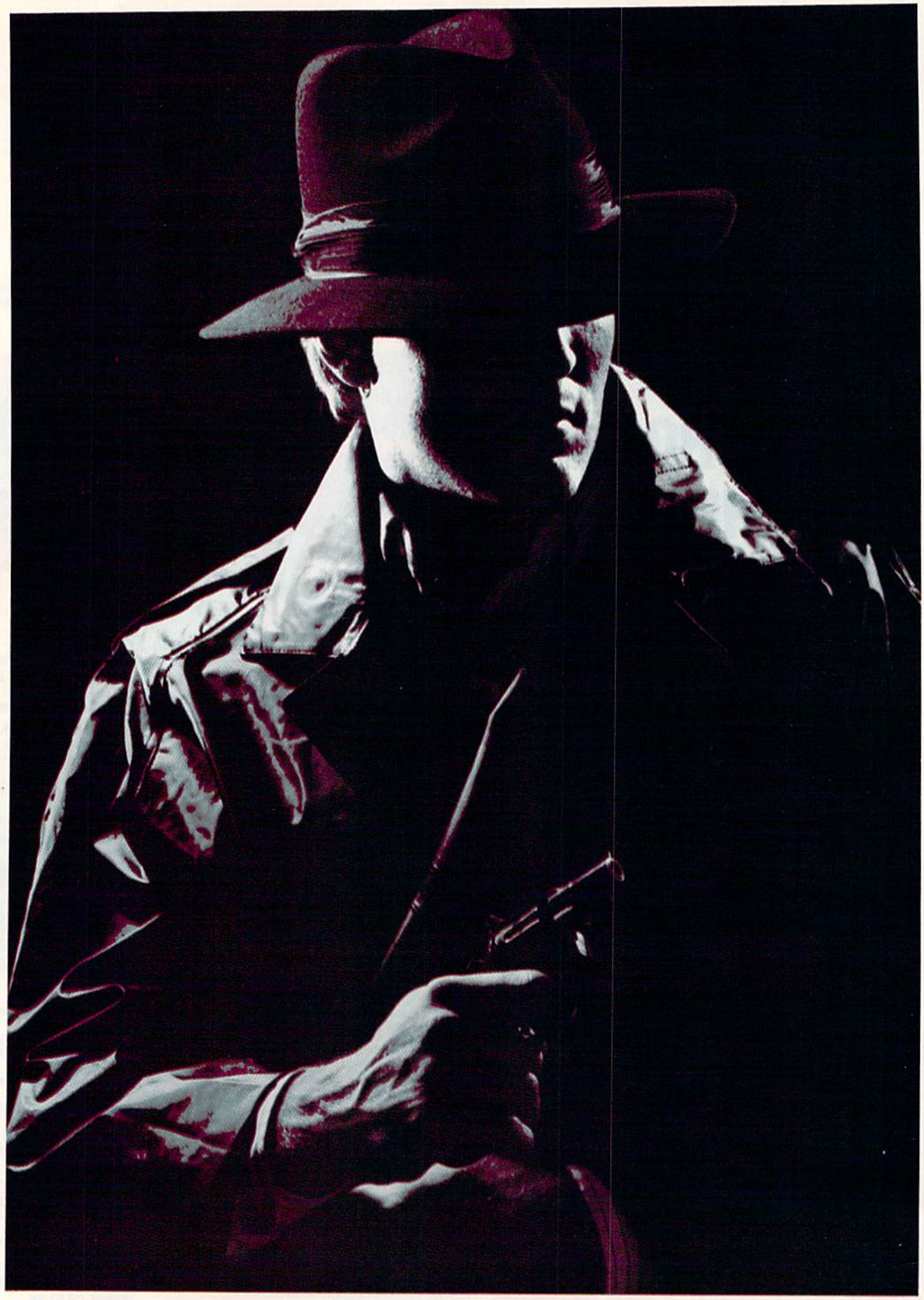

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THE MYSTERY OF LANE MANOR

By JIM SANDERS

Where are Sherlock Holmes, Nero Wolfe and Peter Wimsey when you need them? Someone's been killed at Lane Manor, and you're going to need more than a slick trenchcoat and a funny hat to discover *where*, *with what* and *whodunit*.

Mystery of Lane Manor is a whodunit game, in which the players act as detectives trying to solve the mysterious murder of industrialist James Lane. The mystery is solved (and the winner declared) when the murderer and weapon are discovered and the location of the crime is determined. The correct answers are randomly generated each time the program is run, so the game provides an endless source of mystery.

There are six different rooms where the crime could have occurred. There are five different people who could have murdered Mr. Lane. And there are five weapons that could have been used.

How to Sleuth

To make a guess, each player, in turn, moves a token to the red square in a room.

The step-generator, which is running when the play screen is initially displayed, determines the number of steps you move your token. The player whose name is displayed goes first, by pressing the fire button. This stops the step-generator, and an arrow reveals the number of steps you must move.

Once you've reached the red square, the program will enter the Guess routine, and the list of suspects will be displayed under your name. Move the flashing arrow (via the joystick) to the num-

ber corresponding to the suspect you deem guilty, and push the joystick's fire button to register your guess. Next, the six possible rooms will be listed; guess again and press the fire button. The list of weapons will then be displayed.

After you've made your three guesses, a review of these guesses will be displayed and the number of correct guesses will be revealed.

For an added challenge, at the beginning of the game you're given the option of seeing or not seeing the step-generator pointer. With the pointer invisible, planned movement through the manor is practically impossible. After you make a guess, the token is placed somewhere in the main hallway.

Look Out!

The manor is not without its own hazards. Trapdoors randomly spring open and can become very troublesome. If you fall through a trapdoor, you are forced to begin the trek again, from the home position. As the game progresses, the trapdoors may block doors or eliminate needed guessing squares. You may clear the manor of the trapdoors by pressing the return key. If you do this, both tokens are forced to begin again at the home position.

You may discover all the data to solve the mystery, but your final guess must be made in the room where the crime was committed.

When the mystery is finally solved, the winning detective is congratulated with a musical fanfare and the time it took to solve the mystery.

For your convenience, I've included an itemized list of instructions, which should make learning the game easier. I hope you enjoy playing Mystery of Lane Manor. R

Address all author correspondence to Jim Sanders, 12629 S.R. 347, Marysville, OH 43040.

Table. Summary of play instructions for Mystery of Lane Manor.

1. One or two detectives may work on the case.
2. The object is to solve the murder in the shortest amount of time or, if two players, before your opponent.
3. Murderer, room and weapon must be found.
4. In order to make a guess, you must be in a room and on the red square.
5. You must move your token the number of steps given by the step-generator.
6. After you've made your guesses, you'll be informed how many are correct.
7. After a guess, your token will be placed in the safety of the main hallway.
8. To win, you must solve the murder in the room where it occurred.
9. Guesses are made using the guess-selector, via the joystick and the fire button.
10. The fire button is also used to stop the step-generator.

Listing. Mystery of Lane Manor program.

```
10 DIMP$(5),R$(6),W$(5):G=0
20 TQ1=1665:TP2=1705:PL=1:RE=0:WN=0
30 GOSUB990:GOSUB1140
40 JP=56320:CL=54272:TK=209:PL=1:PO=TQ1
50 FORM=1TOSP
60 J1=PEEK(JP)
70 F1=JIAND16
80 J1=15-(J1AND15)
90 IFJ1=4THEN140
100 IFJ1=8THEN320
110 IFJ1=1THEN500
120 IFJ1=2THEN660
130 GOTO60
140 IFPEEK(PO-1)<>160THEN60
```

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Listing continued.

```
15Ø IFPL=2THEN17Ø
16Ø TQ1=TQ1-1:POKETQ1,2Ø9:POKETQ1+1,16Ø:PO=TQ1:GOTO18Ø
17Ø TP2=TP2-1:POKETP2,218:POKETP2+1,16Ø:PO=TP2
18Ø GOSUB83Ø
19Ø NEXTM
2ØØ RT=INT(RND(Ø)*3)+1:IFRT=2THENGOSUB236Ø
21Ø IFPL=2THEN24Ø
22Ø IFTQ1=15Ø2ORTQ1=15Ø7ORTQ1=1526ORTQ1=1861ORTQ1=1788O
    RTQ1=1966THENGOSUB161Ø
23Ø GOTO25Ø
24Ø IFTP2=15Ø2ORTP2=15Ø7ORTP2=1526ORTP2=1861ORTP2=1788O
    RTP2=1966THENGOSUB161Ø
25Ø IFD=1THEN28Ø
26Ø IFPL=2THENPL=1:GOTO28Ø
27Ø IFPL=1THENPL=2
28Ø GOSUB 154Ø:GOTO2Ø8Ø
29Ø IFPL=1THEN4Ø
3ØØ PL=2:PO=TP2:TK=218:JP=56321
31Ø GOTO5Ø
32Ø IFPEEK(PO+1)<>16ØTHEN6Ø
33Ø IFPL=2THEN35Ø
34Ø TQ1=TQ1+1:POKETQ1,2Ø9:POKETQ1-1,16Ø:PO=TQ1:GOSUB83Ø
    :GOTO37Ø
35Ø TP2=TP2+1:POKETP2,218:POKETP2-1,16Ø:PO=TP2
36Ø GOSUB83Ø
37Ø NEXTM
38Ø RT=INT(RND(Ø)*3)+1:IFRT=2THENGOSUB236Ø
39Ø IFPL=2THEN42Ø
4ØØ IFTQ1=15Ø2ORTQ1=15Ø7ORTQ1=1526ORTQ1=1861ORTQ1=1788O
    RTQ1=1966THENGOSUB161Ø
41Ø GOTO43Ø
42Ø IFTP2=15Ø2ORTP2=15Ø7ORTP2=1526ORTP2=1861ORTP2=1788O
    RTP2=1966THENGOSUB161Ø
43Ø IFD=1THEN28Ø
44Ø IFPL=2THENPL=1:GOTO28Ø
45Ø IFPL=1THENPL=2
46Ø GOSUB 154Ø:GOTO2Ø8Ø
47Ø IFPL=1THEN4Ø
48Ø PL=2:PO=TP2:TK=218:JP=56321
49Ø GOTO5Ø
5ØØ IFPEEK(PO-4Ø)<>16Ø THEN6Ø
51Ø IFPL=2THEN53Ø
52Ø TQ1=TQ1-4Ø:POKETQ1,2Ø9:POKETQ1+4Ø,16Ø:PO=TQ1:GOSUB8
    3Ø:GOTO37Ø
53Ø TP2=TP2-4Ø:POKETP2,218:POKETP2+4Ø,16Ø:PO=TP2
54Ø GOSUB83Ø
55Ø NEXTM
56Ø RT=INT(RND(Ø)*3)+1:IFRT=2THENGOSUB236Ø
57Ø IFTQ1=15Ø2ORTQ1=15Ø7ORTQ1=1526ORTQ1=1861ORTQ1=1788O
    RTQ1=1966THENGOSUB161Ø
58Ø IFTP2=15Ø2ORTP2=15Ø7ORTP2=1526ORTP2=1861ORTP2=1788O
    RTP2=1966THENGOSUB161Ø
59Ø IFD=1THEN62Ø
6ØØ IFPL=2THENPL=1:GOTO62Ø
61Ø IFPL=1THENPL=2
62Ø GOSUB154Ø:GOTO2Ø8Ø
63Ø IFPL=1THEN3Ø
64Ø P=2:PO=TP2:TK=2Ø8:JP=56321
65Ø GOTO5Ø
66Ø IFPEEK(PO+4Ø)<>16ØTHEN6Ø
67Ø IFPL=2THEN69Ø
68Ø TQ1=TQ1+4Ø:POKETQ1,2Ø9:POKETQ1-4Ø,16Ø:PO=TQ1:GOSUB8
    3Ø:GOTO37Ø
69Ø TP2=TP2+4Ø:POKETP2,218:POKETP2-4Ø,16Ø:PO=TP1
7ØØ GOSUB83Ø
71Ø NEXTM
72Ø RT=INT(RND(Ø)*3)+1:IFRT=2THENGOSUB236Ø
73Ø IFTQ1=15Ø2ORTQ1=15Ø7ORTQ1=1526ORTQ1=1861ORTQ1=1788O
    RTQ1=1966THENGOSUB161Ø
```

(continued on page 132)

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EASY KEYPAD

Confessions of a Born Procrastinator

BY JIM STEPHENS

Don't put it off any longer. Do yourself a favor right now. If you're tired of fumbling for the number keys, here's an easy way to add a number keypad for your Commodore 64.

I couldn't put it off any longer. Since I am a born procrastinator, I would avoid the chore of keeping a running balance in my checkbook for as long as possible, which was usually too long. Finally, I bought Computronic's Checkbook 1 program, hoping it would eliminate my monthly overdrawn blues. However, the tedium of entering all the accumulated checks made the checkbook program useless for me.

If you have ever tried to enter 60 or more check amounts at a time, you know that "huntin' and peckin'" on the top row of numerical keys is all a good procrastinator needs to put off this chore even more.

This little keypad project (which I put off as long as I could) was one of the best additions I made to my Commodore 64. With this small numerical pad, I can now enter amounts faster than the computer can prompt. It makes life much easier and my checkbook much more current.

Before I built this keypad, I considered taking apart the console and wiring into the keys. Then I reconsidered—such work might not only void the warranty, it might void the computer itself, since I've been known to blow out whole circuits with my tinkering. If a numerical keypad could be constructed that just hooked into one of the expansion connectors, it would make things much less complicated.

The following project is not only simple, but the keypad conveniently connects into the joystick ports.

Making the Connection

You may use any keypad, as long as it includes all of the necessary numerals, the equals sign and the decimal point. Used calculator keypads will work beautifully if the traces on the keypad circuit board are cut to make each key separate. Many surplus outlets sell these for pennies on the dollar.

Jameco Electronics has an especially good numeric pad (KB-14), with separate connections for each key, for less than $10, new! I chose to use the Jameco pad, since it eliminated trying to get the surplus keypad traces cut and rewired. Although you may use other numeric pads, I will discuss the steps for wiring the Jameco keypad.

Many of you who are adept at programming will immediately see that this keypad can be easily converted for other uses, such as entering Data statements and even machine code. Since more and more programs are being printed that contain page after page of nothing but numbers, this little device could save you hours, just in programming time alone, if a short machine code was devised to handle it. As for me, I'll stick to my checkbook for now and do the machine code later.

You might find it odd that I've used both joystick ports to connect the keypad. I found that port 1 has the connections to the Commodore keyboard *columns*, 0 through 4, and port 2 connects to *rows*, 0 through 4. Since the Commodore's keyboard works by crossing out the matrix of eight columns and eight rows, not all of the numerals and characters are available directly through the ports.

Table 1 shows that the joystick ports have enough connections available to get numbers 3 through 9 and 0, but the numbers 1 and 2 are not directly available. This is not a big problem in Basic programs, since a small conversion routine can be written and inserted to convert some of the other characters to the numbers you need. Further on in this article, I've included a short conversion program that I inserted into Checkbook 1.

Wiring the Jameco Keypad

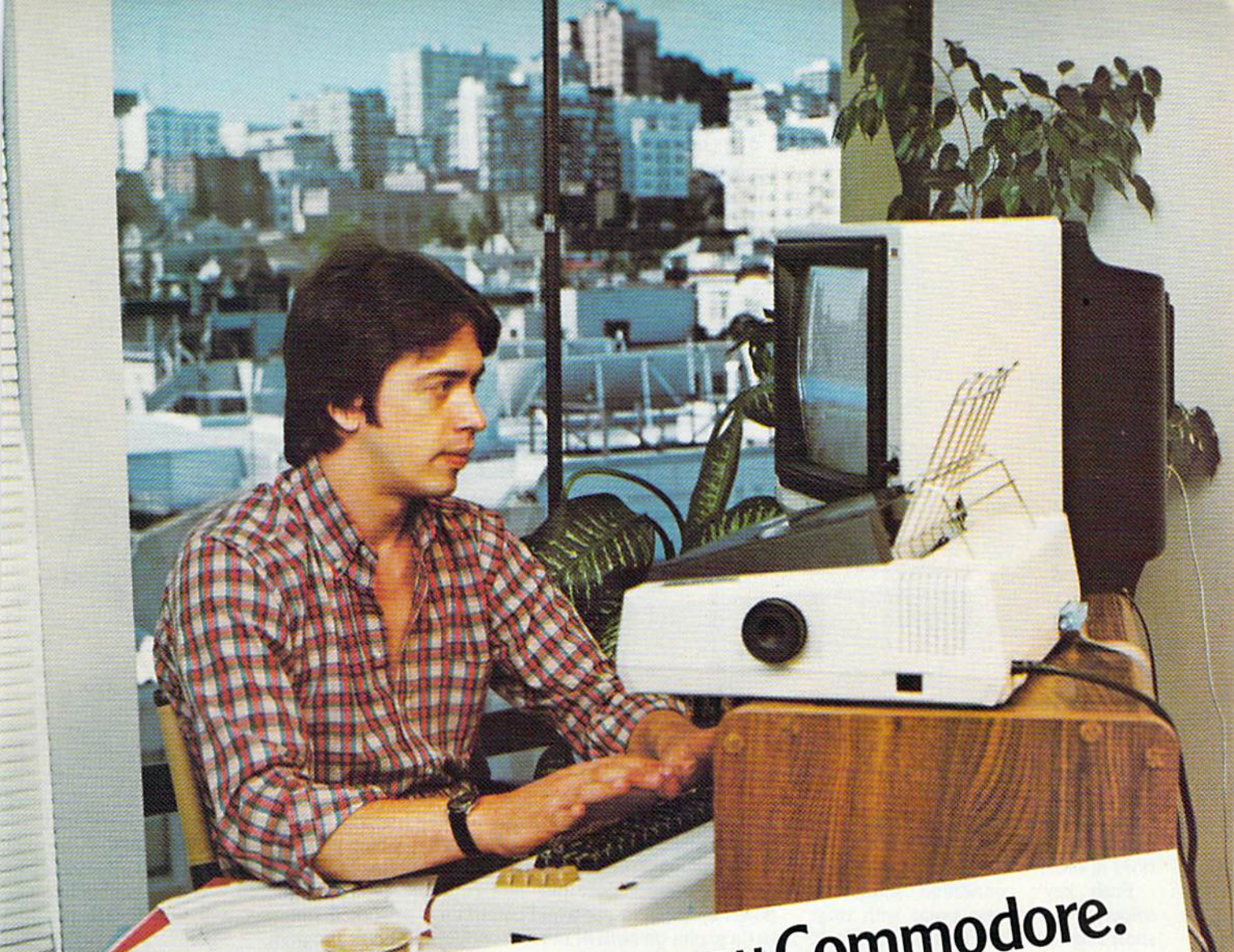
The joystick ports use standard 9-pin RS-232 subminiature female connectors, which are sold by Radio Shack and other supply outlets. Fig. 1 shows how one of these new connectors would appear. Radio Shack's part number for these joystick connectors is 276-1538.

If you use two of these female sockets, as shown in Fig. 2, you'll be able to plug into most of the keyboard numbers with ease. Radio Shack even sells connector hoods for those who like to make their projects neat.

Step 1

The back of the Jameco KB-14 keypad is shown in Fig. 2. Each set of keys is connected in a chain, and there are nine separate chains. The connection chain that goes to pin 4 of port 2 has three connections in the chain—the keys 7, 8 and the decimal point.

Each wire connects to the top pin of its keys on the Jameco keypad. Notice that all of the connections to port 2 connect to the top pins on the keys and all connections to port 1 connect to the bottom pins of the keys. The connecting wire can be almost any multi-strand insulated flexible wire. I find that short



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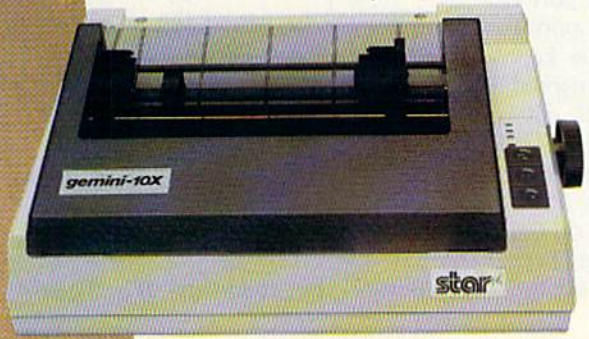

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PORT 1 PINS	PORT 2 PINS	CHARACTER
1	1	backspace
2	1	RETURN
3	1	space
4	1	. . .
6	1	graphic
1	2	3
2	2	W
3	2	A
4	2	4
6	2	Z
1	3	5
2	3	R
3	3	D
4	3	6
6	3	C
1	4	7
2	4	Y
3	4	G
4	4	8
6	4	B
1	6	9
2	6	I
3	6	J
4	6	0
6	6	M

Table 1. By shorting a pin from port 1 to a corresponding pin on Port 2, you may produce various letters and numerals. Do not connect to pins 7 and 8, since these contain the power supply.

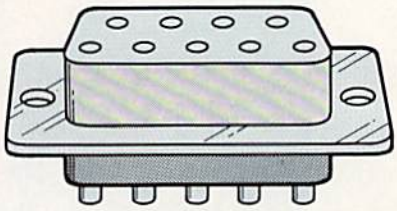

Figure 1. Joystick connector—9-pin D sub connector; Radio Shack #276-1538.

strands of multi-colored ribbon cable work best in keeping all of the connections in order.

Each key's connection should be soldered to the next point with these short lengths of wire, as shown in Fig. 2. If you wire a key in the wrong chain, it won't hurt anything, but the keypad will not work correctly, since the keys will produce incorrect numbers or the keypad will appear to be stuck. The Commodore 64 will deduce that two keys are pressed at the same time.

Step 2

You should have five small chains of keys connected with the top pins of the keys and four small chains connected with the bottom pins. Each chain will connect to a pin on the two new joystick connectors.

Now, solder a 10-inch lead of ribbon cable to each chain and connect it to the appropriate pin of your new port connector, as shown in Fig. 2. For instance, connect the chain that connects to the top pins of keys 1,2,3 and 4 to your port 2 connector at its pin number 2. Connect the chain that connects the bottom pins of keys 0, 4 and 6 to pin 4 on the port 1 connector. Continue connecting the chains to the new joystick connectors until you've connected all nine chains.

When you make connections to the new female 9-pin connectors, be extra careful about shorts. Pins 7 and 8 of the Commodore ports are plus and minus power connections, so avoid connecting to these pins on both of the new connectors. Your new 9-pin port connectors shown in Fig. 2 are drawn as they would appear from the solder point side. The soldered leads to the 9-pin connectors should be insulated with ⅛-inch heat shrink tubing to keep any frayed ends from touching and to help give the connections strength. You will occasionally connect and disconnect the keypad connectors, so the leads will have a tendency to come loose unless you use the connector hoods.

Step 3

Once you've made all of the connections, you're ready to test the new keypad's operation. Label the new connectors port 1 and port 2. Insert the port 1 connector into the 64's joystick port 1 (the one nearest the front of the keyboard) and insert the connector marked port 2 into the 64's rear joystick connector socket.

Turn on the Commodore and wait until the Ready prompt appears. Press key 7 and a seven should appear on the screen. Press each of the remaining keys and note that all of the keys produce the correct numeral except keys 1 and 0—these produce the letters W and Z, respectively. The decimal point produces Y when pressed. This combination worked out very well with the checkbook program.

If the letters and numbers are incorrect or the keypress will not produce a letter or number, recheck your wiring. A nice thing about the keypad is that the equals sign produces the same result as *enter* or *return*.

Converting Letters to Numbers

Listing 2 shows the complete matrix of leads and the corresponding characters that the two ports will produce. I chose to use the leads that produced all the numerals and several letters which were on the same matrix lines. However, any of the extra characters could be used if the right connections were made.

In Checkbook 1, the input of data is accomplished by use of the Get command, and data is placed into a character string (C$). This string is then evaluated by the program to determine its contents. Input is handled in line 50015 as follows.

```
50015 GET C$:IF C$=" " THEN GOTO 50015
50020 IF C$=CHR(13) AND F$=" " AND F=
1 THEN F=0: RETURN
```

I inserted the following If...Then

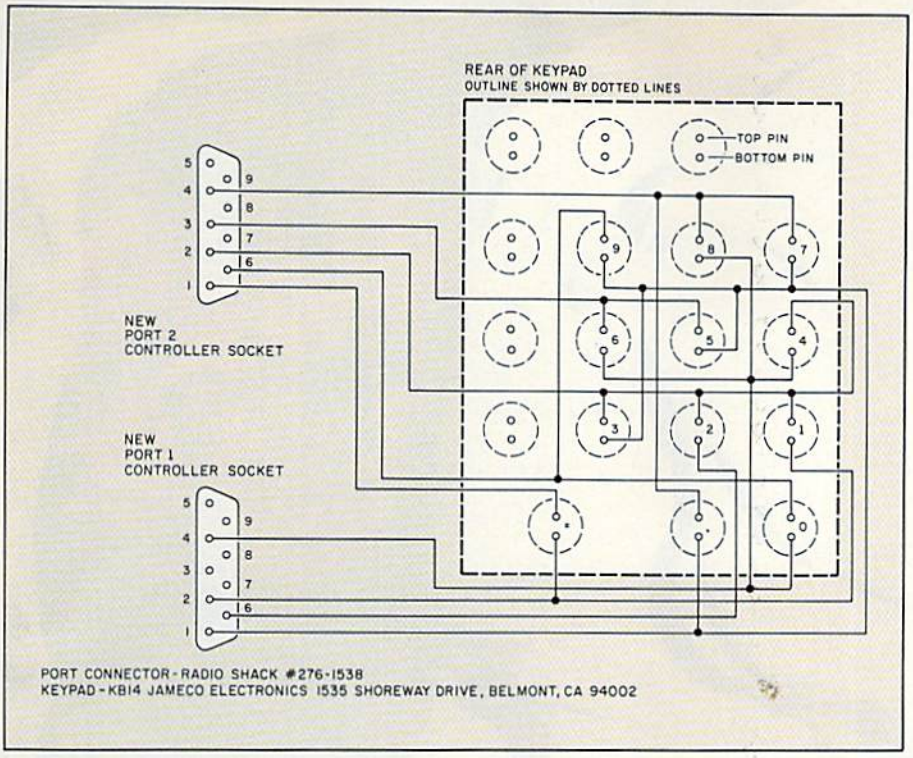

Figure 2. Wiring diagram of the numerical keypad.

statements after the Get command, and the keypad works perfectly.

```
50016 IF C$="W" THEN LET C$="1"
50017 IF C$="Z" THEN LET C$="2"
50018 IF C$="Y" THEN LET C$="."
```

There is still the need to use the full keyboard in Checkbook 1, since many of the prompts request alpha data, but I no longer have to hunt for the numbers on that elusive top row of keys.

Again, notice that the equals key (=) on the pad is wired to activate Enter. This makes data entry much easier.

Although there are commercial keypads available for the Commodore 64, I think the construction of this little unit will do most, if not all, of your numerical chores. Your sense of accomplishment after construction will be worth the effort alone. With proper programming, the keys can be made to represent any characters required.

Now that the keypad is working correctly, maybe I should start writing that machine code to input Data statements. . . nah; maybe tomorrow. R

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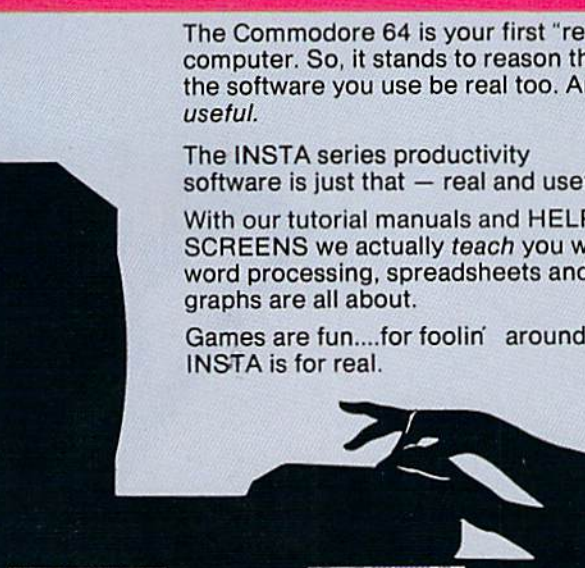

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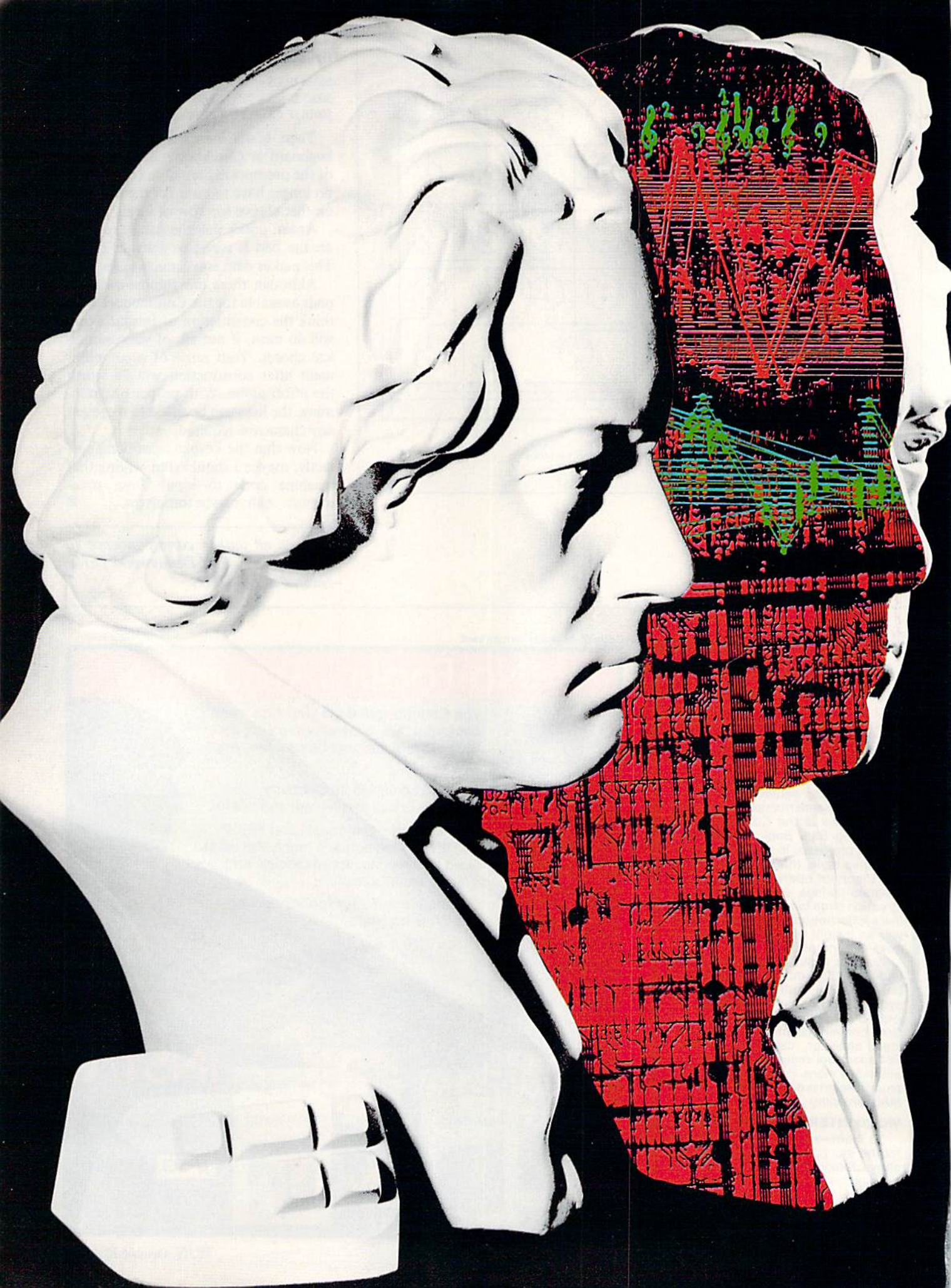


Many games for the C-64 are so enjoyable largely because of the excellent background music or sound effects that often accompany them.

Music is absent from games written in Basic, because it's difficult to handle and slows down the game play tremendously. Although much of the work of producing sound is handled by the SID chip, the program must not only Poke the note changes to SID but also take care of each note's timing.

This article provides you with a machine language program that handles the changing of notes. Its operation is based on the 64's pattern of interrupts. Sixty times each second, the CPU is interrupted—it stops what it's currently doing and does a few housekeeping chores before returning to where it left off. These chores include updating the TI$ clock and checking the keyboard.

SID SERENADE

Add Music To Your Basic Programs Without Missing A Beat

BY M.J. CLIFFORD

Photography By Suzanne Torsheya

Marking Time

The Player program hooks itself into this set of chores, so it's run 60 times each second. It handles the timing of the notes by using two factors, tempo and duration.

If the tempo is set to 4 and the duration to 3, the note will sound for 12 interrupts, or about ⅕ of a second. At that point, the voice circuit is turned off, the next frequency is put into SID and the voice circuit is turned back on. Since this takes place at machine language speed, you don't notice any time lag; the Basic program proceeds at much the same speed as it did without music.

The program in Listing 1 Pokes the machine language into memory and then saves it as a program file on disk or tape. The program resides in the block of memory above Basic, so it doesn't reduce the amount of memory available for the Basic program.

Listing 2 is a Basic program used to prepare the data for the songs. This program can be used to enter new songs or to edit previously entered songs. When editing, the current values are printed on the input line so they may be reentered by pressing the return key if no change is needed.

When a new song is being entered, the program first asks for the ADSR envelope for voice 1. Values of 0–15 are entered for attack, decay, sustain and release. You then select a waveform, using 1 for triangle, 2 for sawtooth, 3 for pulse or 4 for noise. Next, the program asks if you want ring modulation or synchronization, and a pulse width is requested if you're using a pulse wave.

Once you've entered the initial voice parameters, the individual note values are requested. Before you enter the notes, you may enter a key signature. Once you've entered the key signature, you need not enter the sharps and flats normal for that key.

You enter notes using the letters A–G, the octave number (1–7) and the duration value. Sharps are indicated by the # symbol; flats must be entered as the equivalent natural or sharp value. The duration values for various notes are displayed on the screen.

Besides the A–G notation, an R can be entered with an octave value of 0 for a rest, or CV,0,1 can be entered to change the voice's ADSR envelope and waveform in mid song. RE is entered to end the song, followed by the number of repetitions of the song desired (0–15) and the duration of a rest before the repetition begins.

When RE is entered, the program reports the total duration of the song as the equivalent number of sixteenth notes and rests that have been entered. This serves as a check that the three voices are together. When voice 1 is finished, you enter voice 2, then 3.

The Options Are Yours

Once entry is complete, the program enters the Editing mode, in which there are several options. The song may be played at various tempos, the initial envelopes changed, the notes edited or the filters activated.

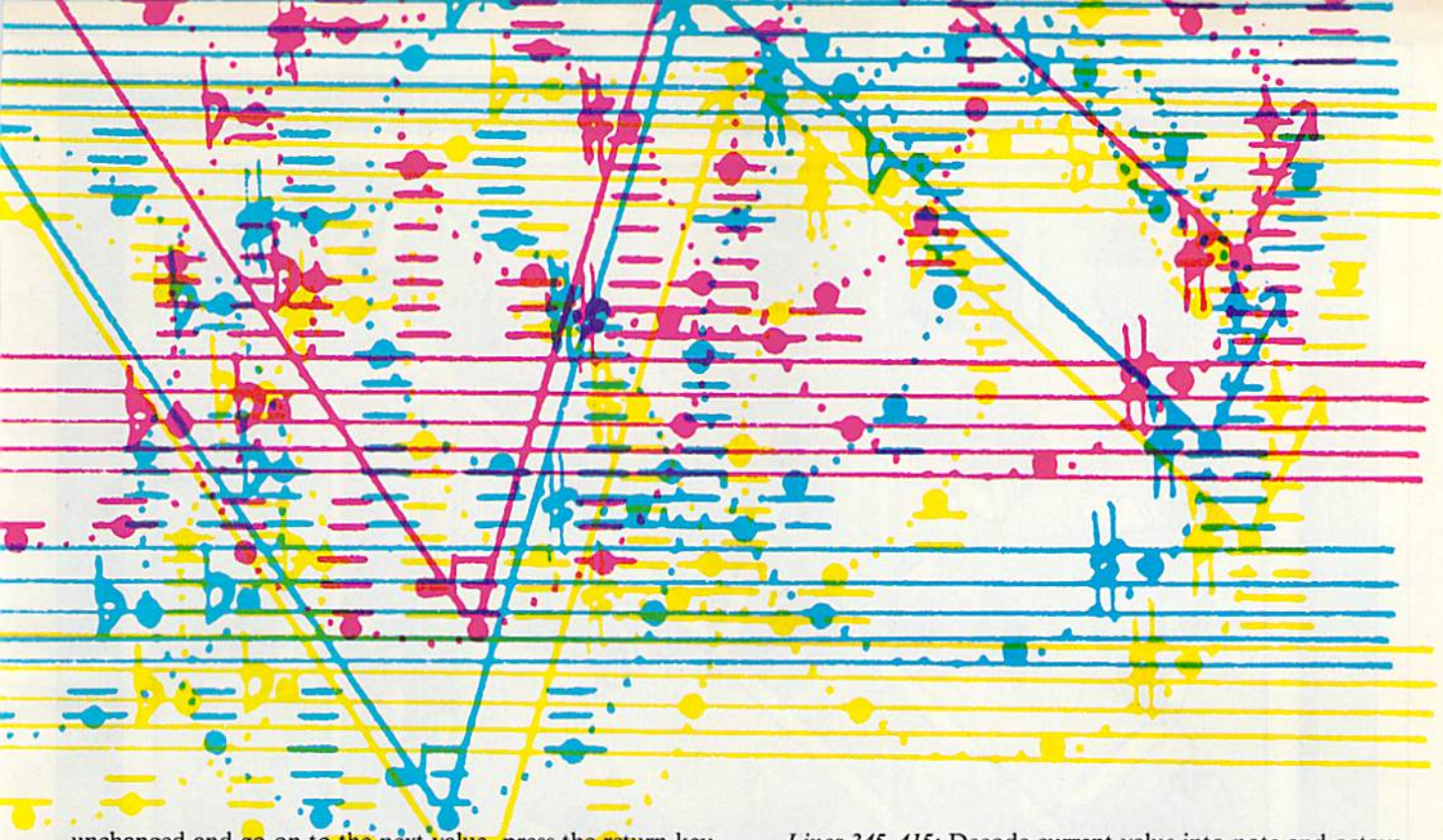
Once editing is complete, the song is saved along with the machine language player in a program file. This song can be loaded later, using the LOAD"song", 8,1 method, and played with a SYS command.

Once the song starts, it will continue to play to its conclusion while Basic functions as usual. Another SYS command is available to stop the music before its conclusion by detaching the player from the interrupt routines and turning off SID.

SYS 49152 will play the song at the default tempo of 4. To use a different tempo, the command is POKE780, tempo: SYS 49154. The command to stop the song is SYS 49344.

To get you started, Listing 3 contains the data for a song. Run this program after running the Loader, then load and run the Song Editor from Listing 2. Choose the Edit mode and then use the various editing options to see how this song was originally entered.

For example, if you choose option 1, Change Wave and so on, the current values for the ADSR envelopes and waveforms will be displayed one at a time. To reenter the value



unchanged and go on to the next value, press the return key as each value is shown.

Choose option 4 to play the song. The tempo should be 4, but you can try other tempos to hear the effect.

Choose option 5 and save the song together with the machine language, and then reload it the next time you use the Song Editor. When you've completed saving the program, type RUN, choose the Edit mode again and try experimenting with different waveforms and filters. To make changes, type in new values over the old values that are displayed, then press the return key.

Description of the Loader

Lines 10–60: Read the data from lines 1001–1048 and Poke it into memory. The last number on each line is a checksum. If a mistake is made in typing the data, the program will halt and report the line number of the data where the mistake occurred.

Lines 80–110: Report the successful loading of the program and offer the option of saving it as a program file.

Line 200: Assigns the name for the program file.

Lines 210–300: Use the Kernal Save routine to save the program on disk. The 8 in line 260 should be changed to a 1 for cassette.

Note: You may omit lines 95–300 if you run this program just before running Song Editor (Listing 2), since Song Editor will save the machine language along with the song data. If, in the future, you use this method, be sure to load a song file before you load and run Song Editor.

Description of Song Editor

Line 10: Loads the ML if necessary.

Lines 20–55: Initialize variables and get choice of new song or edit.

Lines 60–80: Clear memory for new song and set default volume to 15.

Lines 90–100: Enter new song.

Lines 330–495: Input note, octave and duration.

Lines 345–415: Decode current value into note and octave and display with duration on the input line for reentry with return.

Line 420: Inputs values.

Lines 425–435: Check for end, rest or ADSR change.

Lines 440–450: Encode note and octave into a single byte.

Line 470: Prints total of sixteenth notes to keep the three voices together.

Lines 500–790: Get current values and print on input line for reentry.

Lines 530–560: Input attack and decay; combine and Poke into memory.

Lines 570–630: Sustain and release.

Lines 640–660: Decode current waveform; R$ = "Y" if set for ring modulation; S$ = "Y" if set for synchronization.

Lines 670–730: Input wave, ring modulation and synchronization.

Lines 740–780: If pulse wave, get pulse width.

Lines 800–890: Menu of options for editing.

Lines 900–945: Play the song.

Lines 920–940: Do nothing until interrupt vector is restored to normal when song is done, unless the Q key is pressed—then stop song.

Lines 950–1130: Set filters and volume—volume defaults to 15 if this option is not used.

Lines 1600–1695: Set up table of note values according to the key signature. Data is for the key of C—no sharps or flats; if a different key signature is set, then sharps and flats normal for that key should not be entered.

Lines 1700–1790: Print staff showing note and octave ranges and duration counts for various notes.

Lines 1800–1890: On editing, display current key signature's sharps and flats and give option to change.

Lines 1900–1920: Ending dialog.

Lines 2000 and on: Save song and ML together as a program file. *(Listings begin on p. 138)* R

Address all author correspondence to M.J. Clifford, 2323 W. Bancroft, Toledo, OH 43607.

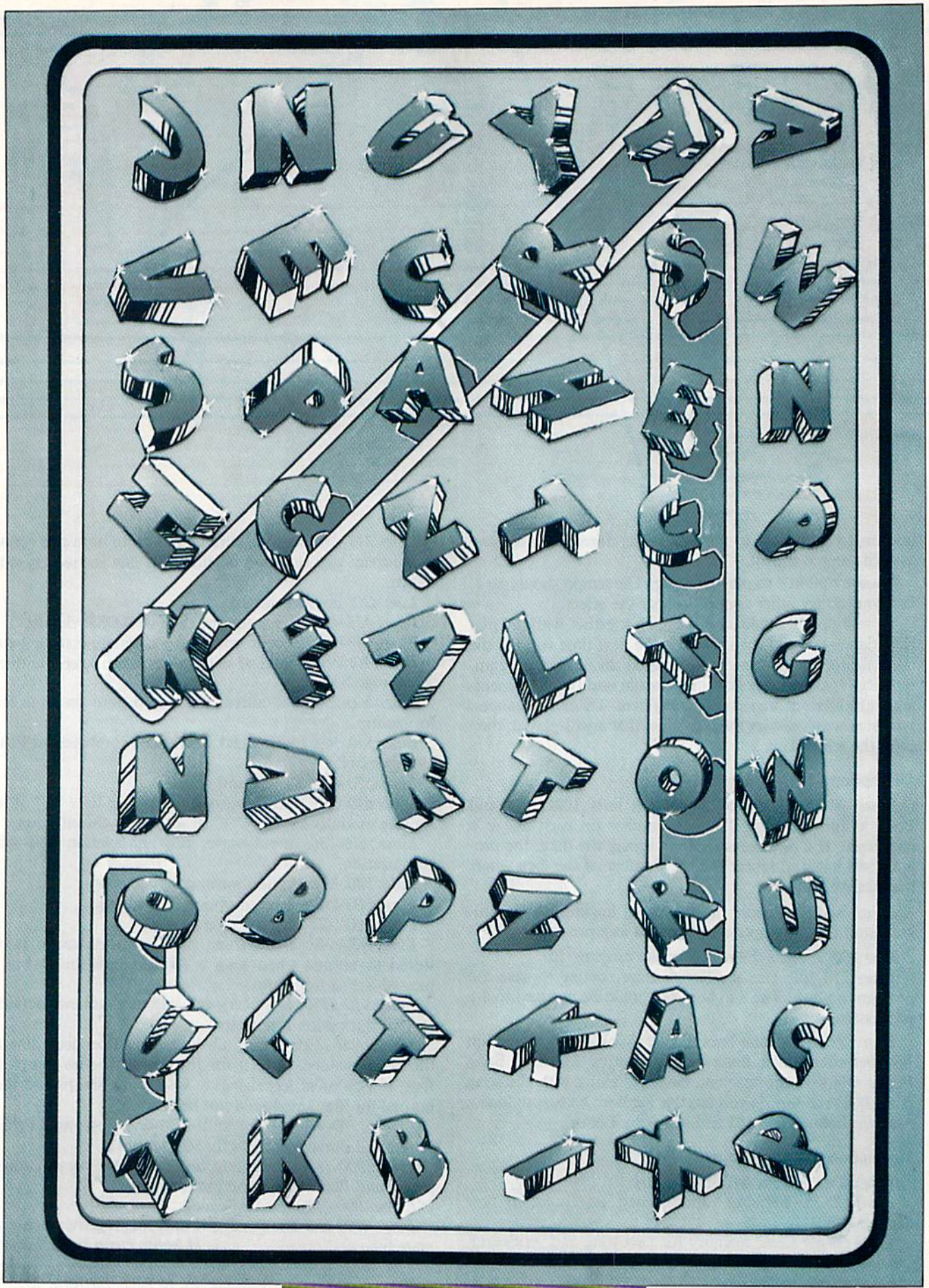


Illustration By Norman Adams

RUN It Right

VIC-20 expanded with 3K/Commodore 64/Printer

If you like playing find-the-word games, you should enjoy this program. I've never been satisfied with similar programs I've run across, so I wanted to create a good, magazine-quality game that would have an easy-to-read printout and be simple to set up.

I wrote the following program for my special education class; the kids really like doing find-the-word games, but have problems with letters spaced too closely together. Find the Word produces a duplication of the commercial find-the-word games. I used a Gemini 10X printer to create Fig. 1. A 1526 printer will produce the same results, but a bit smaller.

The program asks whether you are using a VIC or a 64. You can use either, but the VIC must have at least 3K expansion, as there are just too many arrays for the unexpanded VIC to handle. A response of 20 sets up a black screen and produces a smaller grid.

Line by Line

Line 70 sets up all the arrays that will be used.

Lines 200–300 set up the number of words to be input. Twenty is the maximum. Words must be at least three letters in length and no more than 15. Line 290 checks for length.

Lines 310–370 print the words on the paper in four columns. The printer will then print a row of asterisks. The asterisks will eventually encircle the grid.

Lines 400–560 scramble your words and construct the grid. The screen will display PLEASE

FIND THE WORD

BY GERALD A. CARON

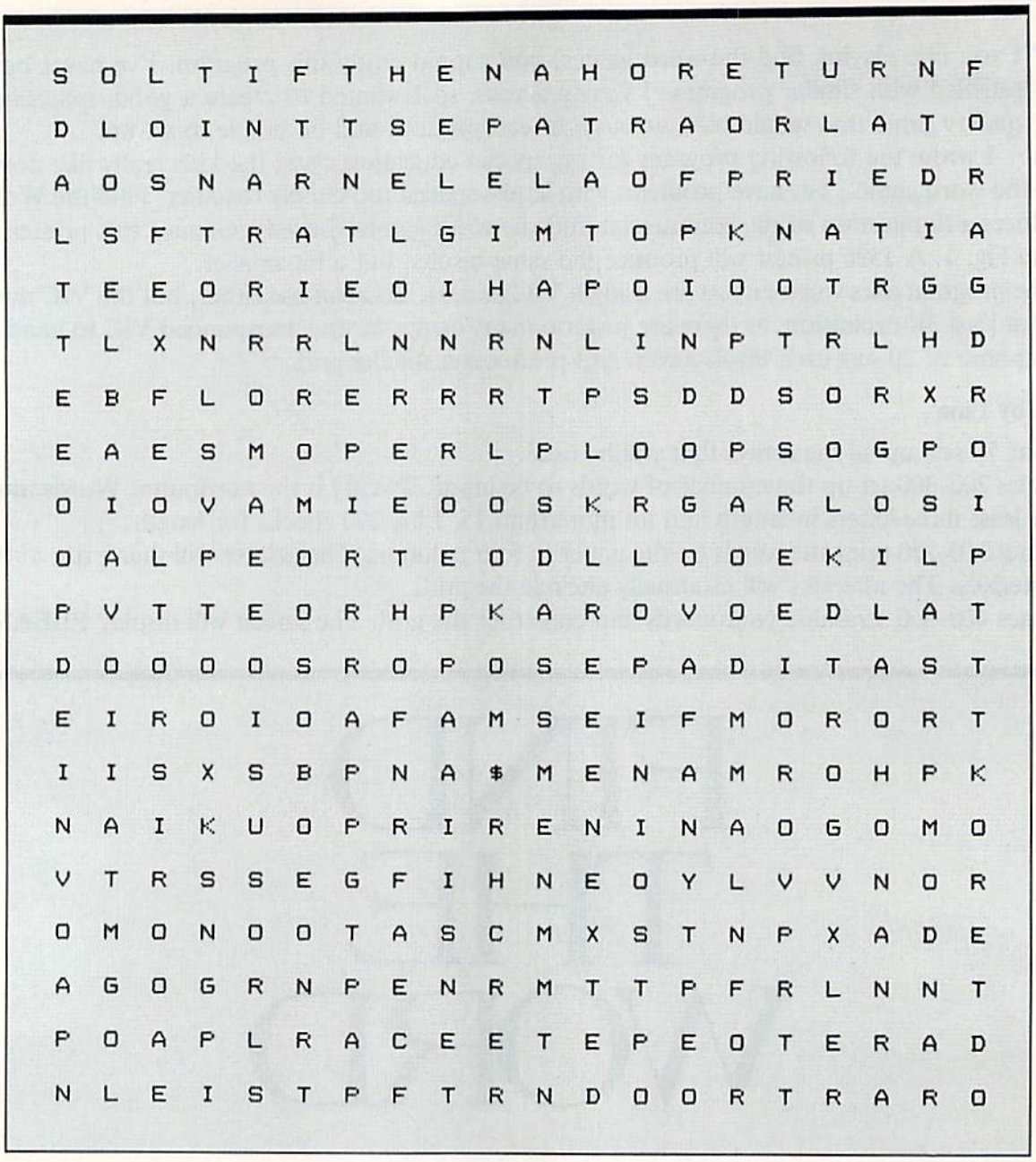

S O L T I F T H E N A H O R E T U R N F
D L O I N T T S E P A T R A O R L A T O
A O S N A R N E L E L A O F P R I E D R
L S F T R A T L G I M T O P K N A T I A
T E E O R I E O I H A P O I O O T R G G
T L X N R R L N N R N L I N P T R L H D
E B F L O R E R R R T P S D D S O R X R
E A E S M O P E R L P L O O P S O G P O
O I O V A M I E O O S K R G A R L O S I
O A L P E O R T E O D L L O O E K I L P
P V T T E O R H P K A R O V O E D L A T
D O O O O S R O P O S E P A D I T A S T
E I R O I O A F A M S E I F M O R O R T
I I S X S B P N A $ M E N A M R O H P K
N A I K U O P R I R E N I N A O G O M O
V T R S S E G F I H N E O Y L V V N O R
O M O N O O T A S C M X S T N P X A D E
A G O G R N P E N R M T T P F R L N N T
P O A P L R A C E E T E P E O T E R A D
N L E I S T P F T R N D O O R T R A R O

Fig. 1. Sample printout of the Find the Word game. Hidden words can be found horizontally, vertically or diagonally.

WAIT. It doesn't take too long, but you'll need a little patience. Think of the number of possibilities the computer must consider. The VIC with 3K took almost three minutes to do a grid with 20 12-letter words.

Lines 600–690 print the matrix on the screen. You could leave this out and go directly to the printer. Of course, if you are going to buy a printer in the future, this section would enable you to try out the program.

If you are using a VIC, there won't be any spaces between letters; if you're using a 64, letters will be separated with a single space. When the screen is finished, the printer will start and print the grid on paper. The grid is over 60 spaces across, with spaces between each letter and a line space between each row. The size is the same for the VIC and the 64.

The last lines allow you to run the program again by typing Y. If you would like a copy of the program, send me $3, and a tape or disk. I'd like also to hear from other educators who are writing programs for their classrooms. R

Address all author correspondence to Gerald A. Caron, 706 Berkley St., Berkley, MA 02780.

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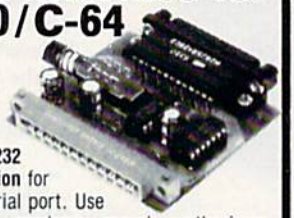

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Listing. Find the Word program for the C-64 and VIC-20

```
10 REM JERRY CARON
12 REM BERKLEY ST.
14 REM BERKLEY,MA.
20 REM INITIALIZE
30 PRINT"{SHFT CLR}{5 CRSR DNs}{3 SPACEs}FIND A WORD"
40 PRINT"{2 CRSR DNs}{2 CRSR RTs}ARE YOU USING":PRINT"{
   2 CRSR RTs}A VIC {CTRL 9}20{CTRL 0} OR A {CTRL 9}64{
   CTRL 0}"
50 INPUT"{CRSR DN}{2 CRSR RTs}ENTER 20 OR 64";MA:IFMA<>
   20AND MA<>64THEN50
55 IFMA=20THENPOKE36879,8
60 PRINT"{SHFT CLR}SETTING UP PLEASE WAIT..."
70 DIME$(20,22),D$(20),ZX(20),ZY(20),QA(8),QB(8),TW(20)
   ,H$(20,22)
80 FORI=1TO20:FORJ=1TO20:E$(I,J)="":NEXT:NEXT
90 RESTORE:FORI=1TO8:READQA(I),QB(I):NEXT
100 DATA0,-1,1,-1,1,0,1,1,0,1,-1,1,-1,0,-1,-1
110 FORI=1TO20:D$(I)="":ZX(I)=0:ZY(I)=0:NEXT
200 REM INPUT WORDS
210 PRINT"{SHFT CLR}{CRSR DN}{CTRL 2}HOW MANY WORDS(MAX
    20){CRSR DN}"
220 INPUT ND$
230 PRINT:NW=VAL(ND$):IFNW<1ORNW>20THEN210
240 PRINT"{SHFT CLR} NOW TYPE IN THE WORDS{CRSR DN}"
250 PRINT"{2 SPACEs}THEY MUST BE BETWEEN 3 AND 15 LETTE
   RS{CRSR DN}"
260 FORI=1TONW
270 PRINTI"{CRSR LF}) ";
280 INPUT"{CRSR LF}";D$(I)
290 IF LEN(D$(I))<3 OR{2 SPACEs}LEN(D$(I))>15 THENPRINT
   CHR$(13)"{3 CRSR UPs}":GOTO270
300 PRINT:NEXT
310 OPEN4,4
320 FORI=1TONW
330 PRINT#4,D$(I);SPC(20-LEN(D$(I)));:IFI=4ORI=8ORI=12O
   RI=16THENPRINT#4,:
340 NEXT
350 PRINT#4,:PRINT#4,:FORR=1TO64:PRINT#4,"*";:NEXTR:PRI
   NT#4,:PRINT#4,"*";
360 PRINT#4," ";SPC(61);"*"
370 CLOSE4
400 REM PLACE
410 PRINT"{SHFT CLR}{2 SPACEs}MAKING GRID "
420 PRINT"{4 SPACEs}PLEASE WAIT"
430 PW=0:FORAB=1TONW:PW=PW+1
440 ZX(PW)=INT(20*RND(1)+1)
450 ZY(PW)=INT(20*RND(1)+1)
460 DR=INT(8*RND(1)+1):TW(PW)=DR
470 CX=ZX(PW)+LEN(D$(PW))*QA(DR):CY=ZY(PW)+LEN(D$(PW))*
   QB(DR)
480 IFCX<1ORCX>20ORCY<1ORCY>20THEN440
490 F=0:FORCK=0TOLEN(D$(PW))-1
500 Z1$=MID$(D$(PW),CK+1,1):Z2$=E$(ZX(PW)+CK*QA(DR),ZY(
   PW)+CK*QB(DR))
510 IFZ2$<>""ANDZ1$<>Z2$THENF=1
520 NEXT:IFF=1THEN440
530 FORCK=0TOLEN({2 SPACEs}D$(PW))-1
540 Z1$=MID$(D$(PW),CK+1,1):E$(ZX(PW)+CK*QA(DR),ZY(PW)+
   CK*QB(DR))=Z1$
550 NEXT
560 NEXT AB
600 REMPRINTSEARCHMATRIX
610 PRINT"{SHFT CLR}"
620 PRINT"{HOME}":FORY=1TO20:FORX=1TO20
622 H$(X,Y)=E$(X,Y):IFE$(X,Y)=""THENH$(X,Y)="-"
```

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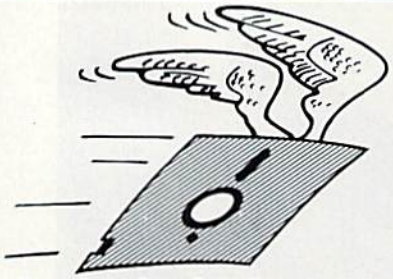

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Listing continued.

```
63Ø IFE$(X,Y)=""THENE$(X,Y)=MID$(D$(NW*RND(1)+1),3*RND(
    1)+1,1)
64Ø IFMA=64THENPRINTE$(X,Y);" ";:GOTO66Ø
65Ø IFMA=2ØTHENPRINTE$(X,Y);
66Ø NEXT
67Ø IFMA=2ØTHENPRINT
69Ø C=Ø:NEXT
7ØØ OPEN4,4
71Ø FORY=1TO2Ø:PRINT#4,"*{2 SPACEs}";:FORX=1TO2Ø
72Ø PRINT#4,E$(X,Y);"{2 SPACEs}";
73Ø NEXT:PRINT#4,"*":PRINT#4,"*";SPC(62);"*":NEXT
74Ø FORR=1TO64:PRINT#4,"*";:NEXTR:PRINT#4,:PRINT#4:CLOS
    E4
8ØØ PRINT"{SHFT CLR}PROGRAM OVER"
8Ø5 PRINT"{CRSR DN}{CRSR RT}WANT THE ANSWERS?"
8Ø6 INPUT"Y OR N";GS$
8Ø7 IFGS$="Y"THENPRINT"DON'T PEEK":GOSUB9ØØ
81Ø INPUT"{2 CRSR DNs}{CRSR RT}{CTRL 9}Y{CTRL Ø}ES TO R
    UN AGAIN ";S$
82Ø IFS$="Y"THENCLR:GOTO3Ø
83Ø END
9ØØ OPEN4,4
91Ø FORY=1TO2Ø:FORX=1TO2Ø
911 PRINT#4,H$(X,Y);" ";
92Ø NEXT:PRINT#4:NEXT
93Ø PRINT#4:CLOSE4:RETURN
```

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SPWRITER

The Sprite Creator's Delight

BY KEITH MEADE

Spwriter, a sprite-editing program, makes it easy to design sprites and include them in your Basic or machine language programs.

Spwriter maintains up to 32 different images in any combination of Single-color and Multi-color modes. Using a joystick or the keyboard, you modify an enlarged image while simultaneously viewing the actual sprite. Machine language coding at critical points gives the program speed and versatility that would not be possible using only Basic. This modular, menu-driven program was designed to be simple to use, and it allows easy analysis and modification.

Type Spwriter (Listing 1) and its companion program, Data Maker (Listing 2), exactly as they are presented. You may omit spaces and remarks, but doing so will make subsequent debugging or alteration more difficult.

To have the best of both worlds, get Spwriter up and running with comments, save it, then go back and delete the spaces and remarks to produce a shorter, faster-loading version.

If you are puzzled by Spwriter's form of remarks, note that you need REM only on comment lines that fall in the path of program execution.

Save a copy of Spwriter before you run it. Typing errors may cause the program to "lock up" your 64; turn the machine off and on to regain control. The checksum variable in lines 6000 and 6005 ensures that you type the Data statements accurately. When you are certain you've correctly entered lines 6020–6250, you may delete line 6005 and the references to TTL in line 6000. This will speed up program initialization a bit.

Data Maker is a utility program, loaded by selecting the D function of Spwriter menu F1. Type and save Data Maker separately from Spwriter, as it's a separate program. Data Maker takes the sprite block or file from the disk and creates Basic Data statements. Data Maker then eats itself up, leaving the Data statements in memory for you to use as you see fit.

The Data statements are numbered beginning at line 1000. The second and third digits in the data line number correspond to the number of the sprite image that the data represents. There are four lines for each image.

Disk users should save Data Maker, with that exact program name, on the same disk as Spwriter. (Tape users: See notes on cassettes at the end of this article.)

Using Spwriter

I have tried, with menus and prompts, to make the Spwriter's operation straightforward. These instructions are intended to supplement those efforts.

Load and run Spwriter. You may edit your sprites with either a joystick or the cursor keys. If you use a joystick, plug it into control port #2.

In the upper-right portion of the Spwriter display is a menu of the currently active program functions.

Outer menu—system overview. This appears upon initialization and may be called up within the program by pressing the shift key with any function key. From here, you should select one of the specialized menus.

F1 menu—file options. This program works with sprites in blocks of 32 images. Saving a block to disk creates a sprite file, to which you assign a name just like any data or program file. Before you load another sprite file, make sure you save the sprites you're currently working on.

When you select D, to make Data statements, Data Maker loads and then runs. Spwriter will no longer be in memory. Data Maker will work with the sprite block currently in memory, or with a sprite file on disk, in which case you'll lose the sprites in memory.

The transfer option (T) allows you to copy a sprite image to another position within the current sprite block. With this ability to replicate an image, you can then make modifications to create animated sequences.

F3 menu—color options. Spwriter assumes a sprite to be in Single-color mode. You can change the current sprite to Multi-color (or back) by pressing M or N from this menu. You can alter the actual display colors by pressing the appropriate key. When the Change-color mode is activated, you can step forward or backward through the Commodore 64 colors by pressing + or −.

Remember, you must reset these color values in the sprite program that you write.

F5 menu—edit sprite. When this menu is active, you can edit the current sprite image, moving the cursor with either the joystick or the cursor keys (whichever method you selected when the program began). You can alter the space under the edit cursor by pressing

RUN It Right

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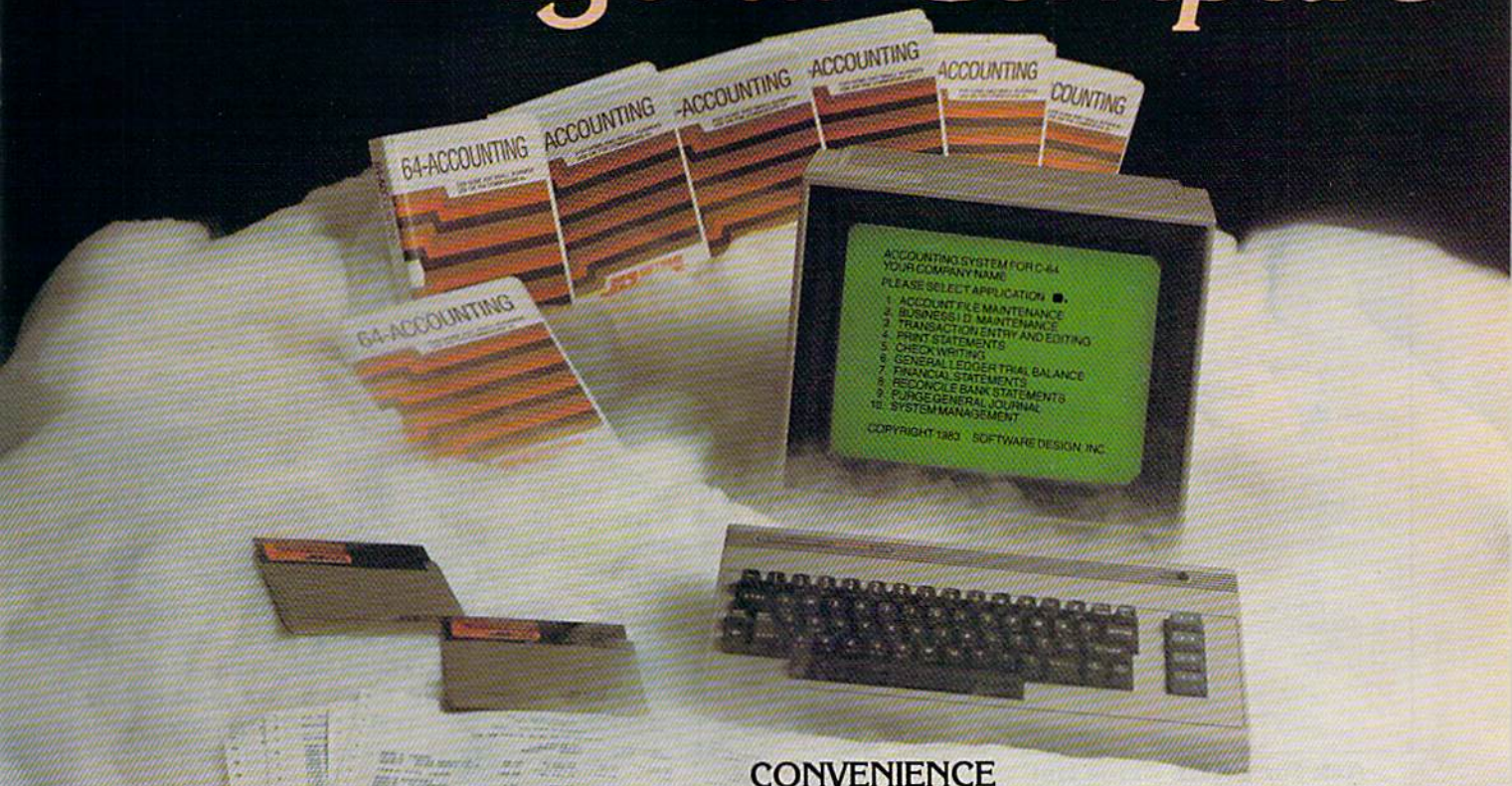

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the joystick trigger or the space bar. This toggles the sprite pixel on and off.

If you are working with a Multi-color sprite, you select the three available colors by pressing 1, 2 or 3. Note that this is the only point in the program where you can change the current sprite image. Step through the images with the + and − keys.

I recommend that you do not scatter sprite images throughout the block, but begin in position #0 and add sprites in consecutive positions. The entire editing process will become clearer with a little practice.

F7—special edit. This menu contains miscellaneous special Spwriter features. Press X or Y to change the width or height of the displayed sprite. Again, remember that you must set these parameters separately in your programs that use the sprites.

In this menu, use the cursor keys to move the image within its frame. I always seem to begin my sprite too close to one of the edges. Be careful with this, as the sprite is cut off at the frame edge.

One existing special-edit feature that requires careful use is C: clear current sprite. Don't use it unless you mean it. If you press C with the CTRL key, you'll erase the entire block of sprites. The power of this key combination is so threatening that I chose not to include it in the menu display.

Finally, in One-color mode, pressing R will reverse the current sprite image. Pressing R again will return you to where you began.

A final note about using Spwriter: You may restart Spwriter (even reload and restart), without disturbing existing sprites, by entering RUN 20.

The Workings of Spwriter

Programmers with a knowledge of sprite graphics should find Spwriter understandable and simple to modify. Spwriter is a Basic program with machine language subroutines. It makes heavy use of that handy area of free RAM above the Basic ROM.

Care has been taken to avoid conflicts with the DOS Wedge program. The 32 sprite images are stored in this area at addresses 49152 to 51199. Program line 6000 stores the machine language at addresses 51200 to 51585. These routines are not relocatable.

The Spwriter display screen is drawn in Extended-background color mode. Editing of the current sprite is done in lines 4500–4650. A machine language routine produces an enlarged version of

Listing 1. The Spwriter program.

```
10 GOSUB 6000:SYS 51200:GOTO 30
20 FORI=0TO385:READA:NEXT
30 POKE 53265,27:PRINT"{SHFT CLR}{4 CRSR DNs} {CTRL 9}J
   {CTRL 0}OYSTICK OR {CTRL 9}K{CTRL 0}EYBOARD EDIT?"
40 GET IN$:IF IN$<>"J" AND IN$<>"K" GOTO 40
50 JOY=2:IF IN$="J" THEN JOY=1:PRINT"{CRSR DN} (PLUG JO
   YSTICK INTO PORT 2)"
60 GOSUB 7000
70 GOSUB 1100
80 GET IN$:IF IN$="" GOTO 80
90 IF IN$=CHR$(133) THEN GOSUB 2000:GOTO 90
100 IF IN$=CHR$(134) THEN GOSUB 3000:GOTO 90
110 IF IN$=CHR$(135) THEN GOSUB 4000:GOTO 90
120 IF IN$=CHR$(136) THEN GOSUB 5000:GOTO 90
130 GOTO 70
990 *
991 *---------------------
992 *{2 SPACEs}1000=MENUS
993 *---------------------
995 *
996 *{2 SPACEs}1000=ERASE MENU,1050=DRAW MENU
997 *
```

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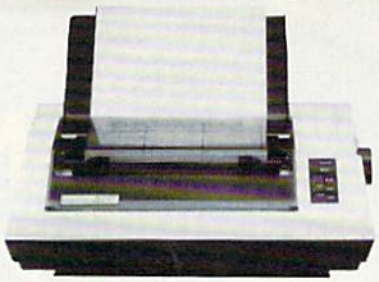

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Elite	9 x 8 + 1	96	60	12	1
Condensed	5 x 8 + 2	136	86	17	1
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Pica	9 x 16 + 3	80	25	10	2
Elite	9 x 16 + 1	96	30	12	2
Proportional	N x 16	—	—	—	2
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Listing 1 continued.

```
1000 FORI=1TO14:LINE$(I)="{12 SPACEs}":NEXT
1050 PLIN$="{HOME}{3 CRSR DNs}{12 CRSR LFs}"
1060 FORI=1TO14:PRINT PLIN$;LINE$(I);:PLIN$=PLIN$+"{CRS
     R DN}":NEXT:RETURN
1096 *
1097 *{2 SPACEs}1100=OUTER MENU
1098 *
1100 GOSUB 1000:LINE$(1)="{4 SPACEs}BY":LINE$(2)=" KEIT
     H MEADE"
1110 LINE$(4)=" F1-FILE":LINE$(5)="{4 SPACEs}OPTIONS"
1120 LINE$(7)=" F3-COLOR":LINE$(8)="{4 SPACEs}OPTIONS"
1130 LINE$(10)=" F5-EDIT":LINE$(11)="{4 SPACEs}SPRITE"
1140 LINE$(13)=" F7-SPECIAL":LINE$(14)="{4 SPACEs}EDIT"
     :GOSUB 1050:RETURN
1196 *
1197 *{2 SPACEs}1200= F1 - MENU
1198 *
1200 GOSUB 1000:LINE$(2)="{4 SPACEs}-F1-":LINE$(3)="FIL
     E OPTIONS"
1210 LINE$(5)=" S SAVE FILE":LINE$(7)=" L LOAD FILE"
1220 LINE$(9)=" T TRANSFER":LINE$(10)="{3 SPACEs}SPRITE
     S"
1230 LINE$(12)=" D MAKE DATA":LINE$(13)="{2 SPACEs}STAT
     EMENTS":GOSUB 1050:RETURN
1296 *
1297 *{2 SPACEs}1300= F3 - MENU
1298 *
1300 GOSUB 1000:LINE$(2)="{4 SPACEs}-F3-":LINE$(3)="COL
     R OPTIONS"
1310 LINE$(5)=" + NEXT COLR":LINE$(6)=" - LAST COLR"
1320 LINE$(8)=" M MULT-COLR":LINE$(9)=" N NORM COLR"
1330 LINE$(11)=" B BACKGRND":IF MODE=0 THEN LINE$(13)="
      F FOREGRND":GOTO 1350
1340 LINE$(12)=" 1 MCM #1":LINE$(13)=" 2 MCM #2":LINE$(
     14)=" 3 MCM #3"
1350 GOSUB 1050:RETURN
1396 *
1397 *{2 SPACEs}1400= F5 - MENU
1398 *
1400 GOSUB 1000:LINE$(2)="{4 SPACEs}-F5-":LINE$(3)=" ED
     IT SPRITE"
1410 LINE$(5)="JSTICK=MOVE":LINE$(6)="TRIGGER=COLR"
1420 IF JOY=2 THEN LINE$(5)="CURSOR=MOVE":LINE$(6)="SPC
      BAR=COLR"
1430 LINE$(8)="SPRITE #"+STR$(SPRNO)
1440 LINE$(9)=" + NEXT SPR.":LINE$(10)=" - LAST SPR.":I
     F MODE=0 GOTO 1460
1450 LINE$(12)=" 1 MCM #1":LINE$(13)=" 2 MCM #2":LINE$(
     14)=" 3 MCM #3"
1460 REV=(11+CNUM)*MODE:GOSUB 1600:RETURN
1496 *
1497 *{2 SPACEs}1500= F7 - MENU
1498 *
1500 GOSUB 1000:LINE$(2)="{4 SPACEs}-F7-":LINE$(3)="SPE
     CIAL EDIT"
1510 LINE$(5)=" X X-EXPAND":LINE$(6)=" Y Y-EXPAND":LINE
     $(8)=" C CLEAR"
1520 IF MODE=0 THEN LINE$(9)=" R REVERSE"
1530 LINE$(11)="CURSOR=SHIFT":GOSUB1050:RETURN
1596 *
1597 *{2 SPACEs}1600=REVERSE A LINE
1598 *
1600 A=REV:IF A>0 THEN IF LEFT$(LINE$(A),1)<>"{CTRL 9}"
      THEN LINE$(A)="{CTRL 9}"+LINE$(A)+"{CTRL 0}"
1610 A=-A:IF A<=0 GOTO 1630
```

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the sprite, using blanks with differing background colors.

The color mode of each sprite is stored in the otherwise unused 64th byte of the sprite definition. A 0 designates Single-color mode. A 1 designates Multi-color mode. I have found this to be a convenient technique in programs using both sprite types.

The program creates and displays two sprites. One of these is the edit cursor, whose image is stored at location #11 (addresses 704–767) and is displayed as sprite #1.

The image currently being edited is moved down to location #13 (832–895) and is displayed as sprite #0.

In the Spwriter memory configuration, sprite locations #14 and #15 (896–1023) remain available. These might be used to add features such as multiple-sprite images or animation-sequence viewing.

Sprite files are merely the block of RAM from $C000-$C7FF stored to disk. Sprite images 0–31 are stored sequentially in this area, each occupying 64 bytes. If any of you machine language programmers want to bypass the Data-statement process, you could use this data directly in your programs.

Cassette Notes

Spwriter was designed to work with a disk drive, but it can be converted. Those of you who are using a cassette will be working with the two Basic programs—Spwriter and Data Maker, plus any sprite files that you create. The worst part of this will be keeping track of all the tapes. You're on your own there.

You must make the following modifications to Spwriter:

1. Line 2160, delete: OPEN 15,8,15:
2. Delete all of lines 2180, 2190 and 2200
3. Line 2400, delete: ",8"
4. Line 6160, change second element in Data statement from 8 to 1.

You must make the following modification to Data Maker:

Line 160, change: ,8,1 to ,1,1 R

Address all author correspondence to Keith Meade, 3111 15th Ave., NW, Rochester, MN 55901.

Listing 1 continued.

```
162Ø IF LEFT$(LINE$(A),1)="{CTRL 9}" THEN LINE$(A)=MID$
     (LINE$(A),2,LEN(LINE$(A))-2)
163Ø GOSUB 1Ø5Ø:RETURN
1993 *
1994 *-------------------------
1995 *{2 SPACEs}2ØØØ=F1 FILE OPTIONS
1996 *-------------------------
1997 *
2ØØØ GOSUB 12ØØ:A=4832Ø+SPRNO*64:FORI=832TO895:POKEA+I,
     PEEK(I):NEXT
2Ø1Ø GET IN$:IF IN$="" THEN 2Ø1Ø
2Ø2Ø A=ASC(IN$):IF A>132 AND A<141 THEN RETURN
2Ø3Ø IF IN$="S" OR IN$="L" GOTO 21ØØ
2Ø4Ø IF IN$="D" GOTO 23ØØ
2Ø5Ø IF IN$="T" THEN GOSUB 25ØØ:GOTO 2Ø1Ø
2Ø6Ø GOTO 2Ø1Ø
2Ø95 *
2Ø96 *{2 SPACEs}21ØØ=SAVE/LOAD SPRITE IMAGE SET
2Ø97 *
21ØØ POKE 53265,27:POKE 53269,Ø:FI$="":INPUT"{SHFT CLR}
     {3 CRSR DNs}ENTER FILE NAME";FI$
211Ø L=LEN(FI$):IF L<1 OR L>16 GOTO 21ØØ
212Ø PRINT"{CRSR DN}FILE NAME = ";FI$:PRINT"{CRSR DN}GO
      AHEAD? (Y OR N)"
213Ø POKE LNAME,L:FOR I=1 TO L:POKE LNAME+I,ASC(MID$(FI
     $,I,1)):NEXT
214Ø GET A$:IF A$="N" GOTO 221Ø
215Ø IF A$<>"Y" GOTO 214Ø
216Ø OPEN 15,8,15:IF IN$="L" THEN SYS 514Ø1
217Ø IF IN$="S" THEN SYS 51375
218Ø INPUT#15,A,B$,C,D:IF A>2Ø THEN PRINT"{CRSR DN}{CTR
     L 9} ERROR {CTRL Ø}"A;B$:PRINT"(PRESS A KEY)
219Ø IF A>2Ø THEN GET A$:IF A$="" GOTO 219Ø
22ØØ CLOSE 15
221Ø RUN 2Ø
2295 *
2296 *{2 SPACEs}23ØØ=CREATE DATA STATEMENTS
2297 *
23ØØ POKE 53265,27:POKE 53269,Ø:PRINT"{SHFT CLR}{2 CRSR
      DNs}THE OPTION TO CREATE DATA STATEMENTS"
231Ø PRINT"LOADS A NEW PROGRAM INTO MEMORY. YOUR"
232Ø PRINT"SPRITE FILE MUST BE ON DISK. SAVE IT"
233Ø PRINT"BEFORE SELECTING THIS OPTION, TO AVOID"
234Ø PRINT"LOSING ALL OF YOUR WORK AND HAVING TO"
235Ø PRINT"RELOAD 'SPWRITER'"
236Ø PRINT"{CRSR DN}DO YOU WISH TO CREATE DATA STATEMEN
     TS{3 SPACEs}AT THIS TIME? (Y OR N)"
237Ø GET A$:IF A$<>"Y" AND A$<>"N" GOTO 237Ø
238Ø IF A$="N" THEN RUN 2Ø
239Ø PRINT"{SHFT CLR}{2 CRSR DNs}PRESS <RETURN>, THEN R
     UN PROGRAM"
24ØØ PRINT"{2 CRSR DNs}LOAD"CHR$(34)"DATA MAKER"CHR$(34
     )",8"
241Ø PRINT"{HOME}{3 CRSR DNs}";
242Ø NEW
2495 *
2496 *{2 SPACEs}25ØØ=TRANSFER SPRITES
2497 *
25ØØ POKE 53265,27:POKE 53269,Ø:A$="Ø":INPUT"{SHFT CLR}
     {3 CRSR DNs}TAKE WHICH SPRITE? (Ø-31)";A$
251Ø S1=VAL(A$):IF S1<Ø OR S1>31 GOTO 25ØØ
252Ø INPUT"{CRSR DN}MOVE TO WHICH SPRITE? (Ø-31)";A$
253Ø S2=VAL(A$):IF S2<Ø OR S2>31 GOTO 252Ø
254Ø PRINT"{CRSR DN}MOVE SPRITE #";S1;" INTO SPRITE #";
     S2:PRINT"CORRECT? (Y OR N)"
```

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Listing 1 continued.

```
255Ø GET A$:IF A$<>"Y" AND A$<>"N" GOTO 255Ø
256Ø IF A$="N" GOTO 25ØØ
257Ø S1=S1*64+49152:S2=S2*64+49152
258Ø FORI=ØTO63:POKES2+I,PEEK(S1+I):NEXT:RUN 2Ø
2993 *
2994 *-----------------------------
2995 *{2 SPACEs}3ØØØ=F3 COLOR OPTIONS
2996 *-----------------------------
2997 *
3ØØØ CNUM=2-MODE:GOSUB13ØØ
3Ø1Ø GET IN$:IF IN$="" THEN 3Ø1Ø
3Ø2Ø A=ASC(IN$):IF A>132 AND A<141 THEN RETURN
3Ø3Ø IF A=49 OR A=5Ø OR A=51 OR A=66 OR A=7Ø THEN GOSUB
     31ØØ:GOTO 3Ø2Ø
3Ø4Ø IF IN$="M" OR IN$="N" THEN GOSUB 32ØØ
3Ø5Ø GOTO 3Ø1Ø
3Ø95 *
3Ø96 *{2 SPACEs}31ØØ=CHANGE A COLOR
3Ø97 *
31ØØ CNUM=VAL(IN$):IF IN$="F" THEN CNUM=2
311Ø REV=11+CNUM:GOSUB 16ØØ
312Ø GET IN$:IF IN$="" THEN 312Ø
313Ø IF IN$="+" THEN COLR(CNUM)=COLR(CNUM)+1:IF COLR(CN
     UM)>15 THEN COLR(CNUM)=Ø
314Ø IF IN$="-" THEN COLR(CNUM)=COLR(CNUM)-1:IF COLR(CN
     UM)<Ø THEN COLR(CNUM)=15
315Ø POKE CSTR(CNUM),COLR(CNUM):IF CNUM>Ø THEN POKE CST
     R(CNUM+3),COLR(CNUM)
316Ø IF IN$="+" OR IN$="-" GOTO312Ø
317Ø REV=-REV:GOSUB 16ØØ:RETURN
3195 *
3196 *{2 SPACEs}32ØØ=SET SPRITE COLOR MODE
3197 *
32ØØ MODE=-(IN$="M"):GOSUB 13ØØ
321Ø XCUR=Ø:YCUR=Ø:POKE5325Ø,XHOME:POKE53251,YHOME
322Ø A=53276:P1=PEEK(A):P2=PEEK(A+1)
323Ø IF MODE=Ø THEN POKE A,(P1 AND 254):POKE A+1,(P2 AN
     D 253):CNUM=2
324Ø IF MODE=1 THEN POKE A,(P1 OR 1):POKE A+1,(P2 OR 2)
     :CNUM=1
325Ø POKE LMODE,MODE:GOSUB 47ØØ:RETURN
3993 *
3994 *-----------------------------
3995 *{2 SPACEs}4ØØØ=F5 EDIT SPRITE
3996 *-----------------------------
3997 *
4ØØØ CNUM=2-MODE:GOSUB 14ØØ
4Ø1Ø GET IN$:A=ASC(IN$+CHR$(Ø)):IF A>132 AND A<141 THEN
      RETURN
4Ø2Ø IF IN$="+" OR IN$="-" THEN GOSUB 48ØØ
4Ø3Ø IF IN$="1" OR IN$="2" OR IN$="3" THEN GOSUB 43ØØ:G
     OTO 4Ø1Ø
4Ø4Ø DIR=Ø:ON JOY GOSUB 41ØØ,42ØØ
4Ø5Ø IF DIR=Ø GOTO 4Ø1Ø
4Ø6Ø IF DIR>Ø AND DIR<9 THEN GOSUB 44ØØ:GOTO 4Ø1Ø
4Ø7Ø I=INT(XCUR/8):BYTE=832+3*YCUR+I:BIT=XCUR-I*8
4Ø8Ø ON (MODE+1) GOSUB 45ØØ,46ØØ:GOTO 4Ø1Ø
4Ø95 *
4Ø96 *{2 SPACEs}41ØØ=JOYSTICK EDIT
4Ø97 *
41ØØ JS=PEEK(5632Ø) AND 31:IF JS=31 THEN RETURN
411Ø IF JS<16 THEN DIR=9:RETURN
412Ø JS=(JS AND 15)-5:DIR=J(JS):RETURN
4195 *
```

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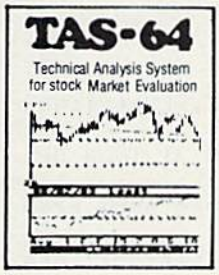

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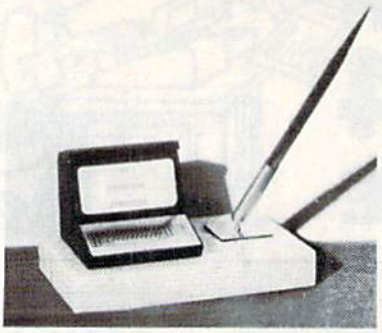

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Listing 1 continued.

```
4196 *{2 SPACEs}42ØØ=KEYBOARD EDIT
4197 *
42ØØ IF IN$="" THEN RETURN
421Ø A$="?{CRSR RT}?{CRSR DN}?{CRSR LF}?{CRSR UP} ":FOR
      I=1 TO 9:IF IN$=MID$(A$,I,1) THEN DIR=I
422Ø NEXT:RETURN
4295 *
4296 *{2 SPACEs}43ØØ=NEW COLOR
4297 *
43ØØ IF MODE=Ø THEN RETURN
431Ø REV=-(11+CNUM):GOSUB 16ØØ:CNUM=VAL(IN$):REV=11+CNU
    M:GOSUB 16ØØ:RETURN
4395 *
4396 *{2 SPACEs}44ØØ=MOVE CURSOR
4397 *
44ØØ XCUR=XCUR+XADV(DIR)*(MODE+1):IF XCUR>23-MODE THEN
    XCUR=Ø
441Ø IF XCUR<Ø THEN XCUR=23-MODE
442Ø YCUR=YCUR+YADV(DIR):IF YCUR>2Ø THEN YCUR=Ø
443Ø IF YCUR<Ø THEN YCUR=2Ø
444Ø POKE 5325Ø,XHOME+8*XCUR:POKE 53251,YHOME+8*YCUR:RE
    TURN
4495 *
4496 *{2 SPACEs}45ØØ=EDIT ONE-COLOR SPRITE
4497 *
45ØØ B=PEEK(BYTE):MB=B AND AMSK(BIT):IF MB<>B THEN POKE
     BYTE,MB:GOTO 452Ø
451Ø MB=B OR OMSK(BIT):POKE BYTE,MB
452Ø GOSUB47ØØ:RETURN
4595 *
4596 *{2 SPACEs}46ØØ=EDIT MULTI-COLOR SPRITE
4597 *
46ØØ B=PEEK(BYTE):MB=B AND AMSK(BIT):MB=MB AND AMSK(BIT
    +1)
461Ø IF MB<>B THEN POKE BYTE,MB:GOTO 465Ø
462Ø MB=B:IF CNUM=3 OR CNUM=2 THEN MB=MB OR OMSK(BIT)
463Ø IF CNUM=3 OR CNUM=1 THEN MB=MB OR OMSK(BIT+1)
464Ø POKE BYTE,MB
465Ø GOSUB47ØØ:RETURN
4696 *
4697 *{2 SPACEs}47ØØ=UPDATE SCREEN DATA
4698 *
47ØØ SYS 51224:RETURN
4794 *
4796 *{2 SPACEs}48ØØ=GET NEW SPRITE IMAGE
4797 *
48ØØ A=4832Ø+SPRNO*64:FORI=832TO895:POKEA+I,PEEK(I):NEX
    T
481Ø IF IN$="+" THEN SPRNO=SPRNO+1:IF SPRNO>31 THEN SPR
    NO=Ø
482Ø IF IN$="-" THEN SPRNO=SPRNO-1:IF SPRNO<Ø THEN SPRN
    O=31
483Ø A=4832Ø+SPRNO*64:FORI=832TO895:POKEI,PEEK(A+I):NEX
    T:MODE=PEEK(LMODE)
484Ø GOSUB 321Ø:XCUR=Ø:YCUR=Ø:POKE 5325Ø,XHOME:POKE 532
    51,YHOME
485Ø GOSUB 14ØØ:GOSUB 47ØØ:RETURN
4993 *
4994 *---------------------------
4995 *{2 SPACEs}5ØØØ=F7 SPECIAL EDIT
4996 *---------------------------
4997 *
5ØØØ GOSUB 15ØØ
5Ø1Ø GET IN$:IF IN$="" THEN 5Ø1Ø
```

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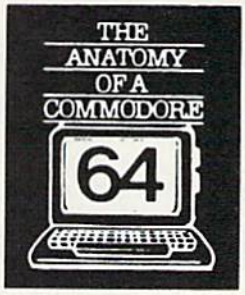

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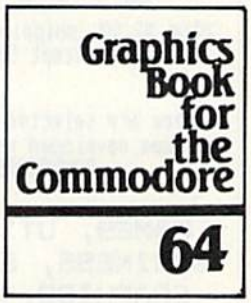

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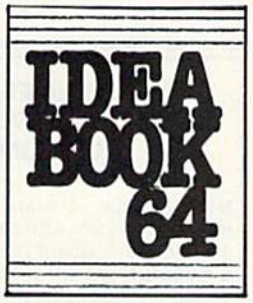

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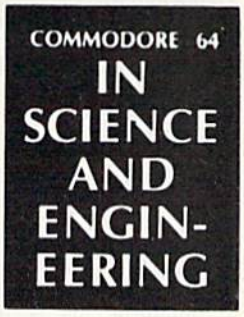

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Listing 1 continued.

```
5020 A=ASC(IN$):IF A>132 AND A<141 THEN RETURN
5030 IF IN$="X" OR IN$="Y" THEN GOSUB 5100:GOTO 5010
5040 IF IN$="C" OR IN$=CHR$(3) THEN GOSUB 5200:GOTO 501
     0
5050 IF IN$="{CRSR DN}" OR IN$="{CRSR UP}" OR IN$="{CRS
     R LF}" OR IN$="{CRSR RT}" THEN GOSUB 5300:GOTO 501
     0
5060 IF IN$="R" THEN GOSUB 5400
5070 GOTO 5010
5095 *
5096 *{2 SPACEs}5100=X,Y EXPAND
5097 *
5100 IF IN$="X" THEN XXPND=NOT(XXPND)
5110 IF XXPND THEN POKE 53277,(PEEK(53277) OR 1)
5120 IF NOT(XXPND) THEN POKE 53277,(PEEK(53277) AND 254
     )
5130 IF IN$="Y" THEN YXPND=NOT(YXPND)
5140 IF YXPND THEN POKE 53271,(PEEK(53271) OR 1)
5150 IF NOT(YXPND) THEN POKE 53271,(PEEK(53271) AND 254
     )
5160 RETURN
5195 *
5196 *{2 SPACEs}5200=CLEAR 1 OR ALL SPRITES
5197 *
5200 IF IN$=CHR$(3) THEN SYS 5120:MODE=0:GOSUB 3210
5210 FORI=832TO894:POKEI,0:NEXT:POKE LMODE,MODE:GOSUB 4
     700:RETURN
5295 *
5296 *{2 SPACEs}5300=SHIFT SPRITE IMAGE
5297 *
5300 IF IN$="{CRSR DN}" THEN SYS 51452:GOTO 5340
5310 IF IN$="{CRSR UP}" THEN SYS 51485:GOTO 5340
5320 IF IN$="{CRSR LF}" THEN SYS 5152:GOTO 5340
5330 IF IN$="{CRSR RT}" THEN SYS 51553
5340 GOSUB 4700:RETURN
5395 *
5396 *{2 SPACEs}5400=REVERSE 1 COLOR SPRITE
5397 *
5400 IF MODE THEN RETURN
5410 FORI=832TO894:POKEI,255-PEEK(I):NEXT:GOSUB4700:RET
     URN
5994 *
5995 *--------------------------
5996 *{3 SPACEs}6000=LOAD ML ROUTINES
5997 *--------------------------
5998 *
6000 TTL=0:FORI=5120TO51585:READA:POKEI,A:TTL=TTL+A:NE
     XT
6005 IF TTL<>49732 THEN PRINT"{CTRL 9} ERROR IN DATA ST
     ATEMENTS 6020-6250 ":STOP
6010 RETURN
6020 DATA 169,192,133,252,169,0,133,251,162,8,168,145,2
     51,136,208,251
6030 DATA 230,252,202,208,246,96,0,0,169,64,133,251,169
     ,3,133,252
6040 DATA 169,81,133,253,169,4,133,254,169,0,141,22,200
     ,162,3,160
6050 DATA 0,177,251,141,23,200,160,8,173,127,3,208,6,32
     ,108,200
6060 DATA 76,70,200,32,123,200,230,251,165,253,24,105,8
     ,133,253,144
6070 DATA 2,230,254,202,208,217,165,253,24,105,16,133,2
     53,144,2,230
6080 DATA 254,238,22,200,173,22,200,201,21,208,194,96,1
     69,32,78,23
```

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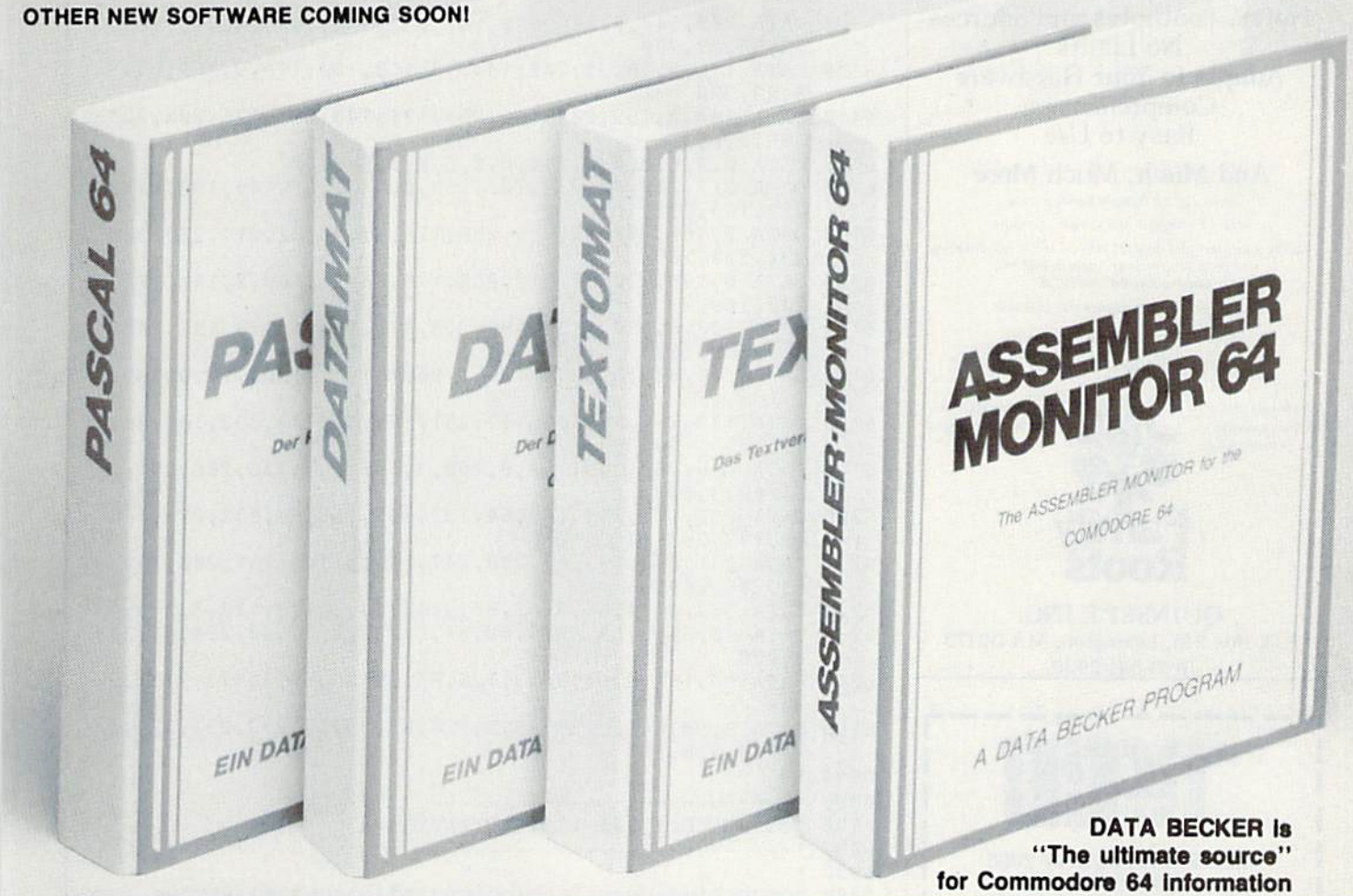

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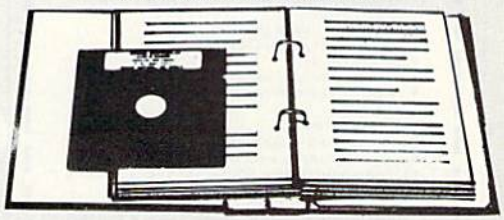

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6090 DATA 200,144,2,169,160,145,253,136,208,242,96,169,
     32,78,23,200
6100 DATA 176,9,78,23,200,144,13,169,160,176,9,169,96,7
     8,23,200
6110 DATA 144,2,169,224,145,253,136,145,253,136,208,223
     ,96,0,0,0
6120 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,32
6130 DATA 217,200,32,234,200,169,0,133,251,169,192,133,
     252,169,251,162
6140 DATA 0,160,200,32,216,255,176,47,96,32,217,200,32,
     234,200,169
6150 DATA 0,168,170,32,213,255,176,31,96,169,0,141,174,
     200,169,2
6160 DATA 162,8,160,1,32,186,255,176,14,96,173,157,200,
     162,158,160
6170 DATA 200,32,189,255,176,1,96,141,174,200,96,0,169,
     3,133,252
6180 DATA 133,254,169,63,133,251,169,66,133,253,160,60,
     177,251,145,253
6190 DATA 136,208,249,169,0,160,3,145,251,136,208,251,9
     6,169,3,133
6200 DATA 252,133,254,169,64,133,251,169,67,133,253,160
     ,0,177,253,145
6210 DATA 251,200,192,60,208,247,169,0,145,251,200,192,
     63,208,249,96
6220 DATA 162,0,30,66,3,62,65,3,62,64,3,173,127,3,240,9
6230 DATA 30,66,3,62,65,3,62,64,3,232,232,232,224,63,20
     8,226
6240 DATA 96,162,0,94,64,3,126,65,3,126,66,3,173,127,3,
     240
6250 DATA 9,94,64,3,126,65,3,126,66,3,232,232,232,224,6
     3,208,226,96
6994 *
6995 *--------------------------
6996 *{3 SPACEs}7000=INITIALIZATION
6997 *--------------------------
6998 *
7000 GOSUB 7100:GOSUB7200:GOSUB7300:GOSUB7400:RETURN
7095 *
7096 *{2 SPACEs}7100=INITIALIZE CONSTANTS
7097 *
7100 FORI=0TO4:CSTR(I)=53281+I:NEXT
7110 CSTR(5)=53287:CSTR(6)=53286
7120 FORI=0TO9:READ XADV(I),YADV(I),J(I):NEXT
7130 DATA 0,0,3,1,-1,1,1,0,2,1,1,0,0,1,5,-1,1,7,-1,0,6,
     -1,-1,0,0,-1,4,0,0,8
7140 FORI=0TO7:READAMSK(I),OMSK(I):NEXT
7150 DATA 127,128,191,64,223,32,239,16,247,8,251,4,253,
     2,254,1
7160 DIM LINE$(14):XHOME=36:YHOME=64:LMODE=895
7170 LNAME=51357:RETURN
7195 *
7196 *{2 SPACEs}7200=INITIALIZE VARIABLES
7197 *
7200 COLR(0)=15:COLR(1)=2:COLR(2)=6:COLR(3)=5
7210 CNUM=2:SPRNO=0:XXPND=-1:YXPND=-1:XCUR=0:YCUR=0:RET
     URN
7295 *
7296 *{2 SPACEs}7300=INITIALIZE SPRITES
7297 *
7300 FORI=704TO766:POKEI,0:NEXT
7310 FORI=704TO737STEP3:READA:POKEI,A:READA:POKEI+1,A:N
     EXT
7312 DATA 255,240,255,240,192,48,192,48,192,48,192,48,1
     92,48,192,48
```

More

Listing 1 continued.

```
7314 DATA 192,48,192,48,255,24Ø,255,24Ø
732Ø FORI=832TO895:POKEI,PEEK(I+4832Ø):NEXT:MODE=PEEK(L
     MODE):POKE53276,MODE
733Ø POKE 2Ø4Ø,13:POKE 2Ø41,11:POKE53271,1:POKE53277,1+
     2*MODE
734Ø POKE53269,3:POKE 53287,COLR(2):POKE 53288,Ø
735Ø POKE 53248,8:POKE53249,186:POKE53264,1
736Ø POKE 5325Ø,XHOME:POKE 53251,YHOME:RETURN
7395 *
7396 *{2 SPACEs}74ØØ=DRAW SCREEN
7397 *
74ØØ POKE 53265,(PEEK(53265) OR 64)
741Ø FORI=ØTO3:POKE CSTR(I),COLR(I):POKE CSTR(I+3),COLR
     (I):NEXT
742Ø PRINT"{SHFT CLR}{COMD 4}";:POKE 5328Ø,15:POKE 5328
     1,15:A$="{CTRL 9}++++++++++++++++++++++++++++{CTRL
     Ø}"
743Ø PRINT A$:PRINT A$:PRINT "{21 CRSR DNs}";A$:PRINT A
     $;"{HOME}{2 CRSR DNs}";
744Ø A$="{CTRL 9}++{CTRL Ø}{24 SPACEs}{CTRL 9}++{CTRL Ø
     }"
745Ø FORI=1TO21:PRINT A$:NEXT:PRINT"{HOME}{COMD 4}{2 CR
     SR DNs}{1Ø CRSR LFs}SPWRITER"
746Ø GOSUB 47ØØ:RETURN
```

Listing 2. The Data Maker program.

```
1ØØ IF A=1 GOTO 17Ø
11Ø POKE 53265,PEEK(53265) AND 191:POKE 53269,Ø:POKE 53
    281,1
12Ø PRINT"{SHFT CLR}{CRSR DN}DATA MAKER":PRINT"{2 CRSR
    DNs}ARE THE SPRITES NOW IN MEMORY? (Y/N)"
13Ø GET IN$:IF IN$<>"Y" AND IN$ <>"N" GOTO 13Ø
14Ø IF IN$="Y" GOTO 17Ø
15Ø FI$="":INPUT"{CRSR DN}SPRITE FILE NAME";FI$:IF FI$=
    "" GOTO 15Ø
16Ø A=1:LOAD FI$,8,1
17Ø PRINT"{SHFT CLR}{2 CRSR DNs}ENTER BEGINNING SPRITE
    # (Ø-31)":INPUT"{3 CRSR RTs}Ø{3 CRSR LFs}";S
18Ø IF S<Ø OR S>31 GOTO 17Ø
19Ø PRINT"{2 CRSR DNs}ENTER ENDING SPRITE # (Ø-31)":INP
    UT SE:IF SE<S OR SE>31 GOTO 19Ø
2ØØ M=49152+64*S
21Ø IF S>SE THEN GOTO 26Ø
22Ø LIN=1ØØØ+1Ø*S:S=S+1:PRINT"{SHFT CLR}{4 CRSR DNs}{CO
    MD 4}";
23Ø FORL=ØTO3:PRINTLIN+L;"DATA ";:FORD=1TO16:A=PEEK(M):
    M=M+1:GOSUB34Ø:NEXT
24Ø PRINT"{CRSR LF} ":NEXT:PRINT"{CTRL 2}S="S":SE="SE":
    M="M":GOTO 21Ø{HOME}"
25Ø FORI=ØTO4:POKE631+I,13:NEXT:POKE198,5:STOP
26Ø LIN=1ØØ
27Ø PRINT"{SHFT CLR}{4 CRSR DNs}{CTRL 2}";:FORI=LIN TO
    LIN+7Ø STEP1Ø:PRINT I:NEXT
28Ø LIN=LIN+8Ø:PRINT"LIN="LIN":GOTO 3ØØ{HOME}"
29Ø FORI=ØTO8:POKE631+I,13:NEXT:POKE198,9:STOP
3ØØ IF LIN=18Ø GOTO 27Ø
31Ø PRINT"{COMD 4}{SHFT CLR}{CRSR DN}SAVE YOUR DATA STA
    TEMENTS{2 CRSR DNs}{CTRL 2}"
32Ø FORI=26ØTO34ØSTEP1Ø:PRINTI:NEXT:PRINT"{HOME}{COMD 4
    }"
33Ø FORI=ØTO9:POKE631+I,13:NEXT:POKE198,1Ø:STOP
34Ø A$=MID$(STR$(A),2,3)+",":PRINT A$;:RETURN
```


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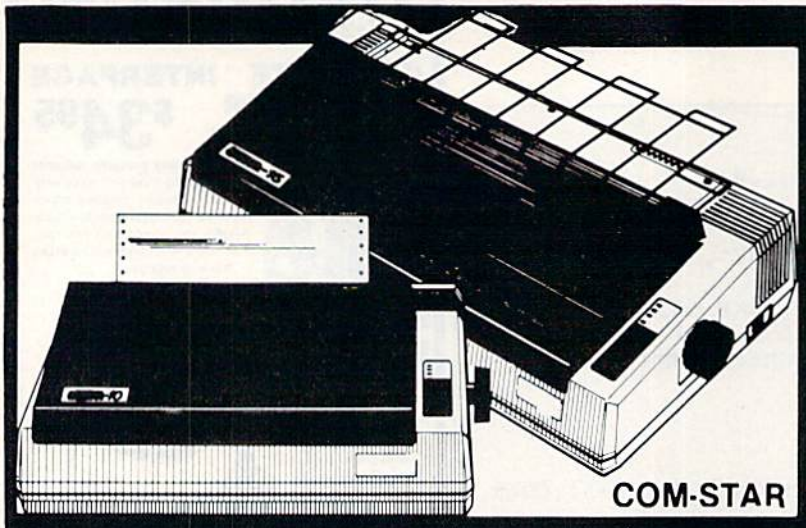

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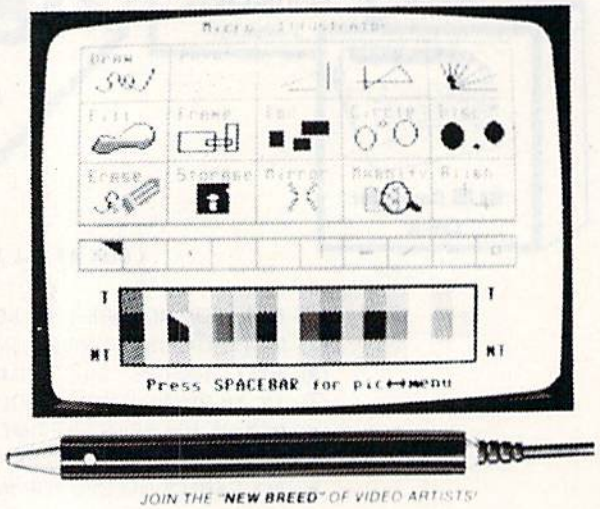

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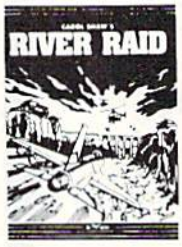
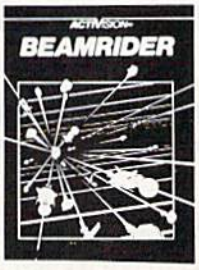


River Raid — Voted Best Action game by Electronic Games Magazine. Now you can play the extended version of the all time great home video game. Over 5000 enemy targets and fantastic action and sound will keep you busy for days. (Highly Recommended) List $39.95. **Sale $27.95**. (Disk)

Pitfall II - Lost Caverns — The feats of Pitfall Harry continue with the full advantages of the Commodore-64. The caverns are 27 levels deep and you must make Harry swim through rivers, float through the air on balloons, even freefall with perfect timing. Fantastic sound, graphics, and action. (Very Highly Recommended) List $39.95. **Sale $27.95**. (Disk)

Beamrider — (Better than Tempest) Move and fire along the grid as aliens attempt to destroy you. Super fast joystick action is the only thing that will keep you alive to make it to the next grid (99 grids) where more challenges await you. Super Action and Graphics. List $39.95. **Sale $27.95**. (Disk)



Decathalon — Finally an Olympic Event for two players at the same time (or play against the computer) Run, Hurl, Vault, Jump and more (10 events in all). Fantastic graphics and sound will keep you playing this one for days on end. Great Competition. List $39.95. **Sale $27.95**. (Disk)

Toy Bizarre — The toy factory has gone crazy. Toys spring to life and try to destroy you and the factory. Jump from level to level and close the valves, and capture the toys before the toys do you and the factory in. Fantastic Graphics and Sound. List $39.95. **Sale $27.95**. (Disk)

H.E.R.O. — Descend through the caverns with your dynamite and laser helmet; clear the tunnels to rescue the trapped miners; watchout for molten lava, animals, insects, etc. If you hit the lights they go out and you're in the dark. Fantastic Graphics and Sound combine with a superb theme to make this a best game for the year. List $39.95. **Sale $27.95**. (Disk)

Zenji — Find your way through the paths. Easy? The paths constantly change as the squares slide around. Use your senses to decide which way is out. If your senses fail, you are trapped and dead! Fantastic action. List $39.95. **Sale $27.95**. (Disk)

Zone Ranger — Better than Asteroids and Omega Race. You must pilot your starship first through asteroid alien territory and dock at your base, then you must make your way through the mazes past hostile aliens. Constantly 4-way scrolling screens make this a must for all game players. Fantastic Graphics and Action. List $39.95. **Sale $27.95**. (Disk)

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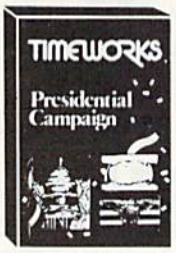

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Intermediate game design and Sprite Builder. Design Slot Machine and study intermediate programming including arrays, subroutines, sound, special function keys, and random function. Plus Sprites are covered in detail and a Sprite Editor is included. List $24.95. **Sale $19.95.**

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At last a good educational game. You must wander through 3-D mazes until you encounter dragons, then you must answer the algebra problems they give you. A right answer gets you a free ride, a wrong answer gets you eaten. Fantastic educational value. (Tape or Disk.) List $29.95. **Sale $24.95.**

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The screen is sprinkled with the letters from one of 20 words of your choice along with a few extra random ones. Use your Joystick to sting the letters in the right order but don't sting the wrong ones or cross your path or you explode. Fantastic educational value. Fun for all ages. List $24.95. **Sale $17.95.**

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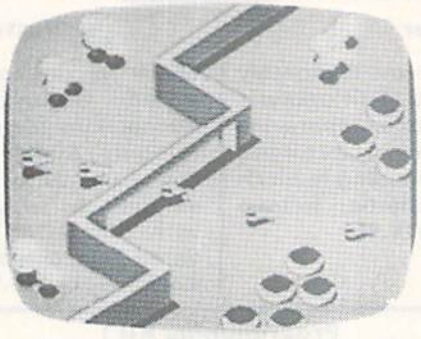
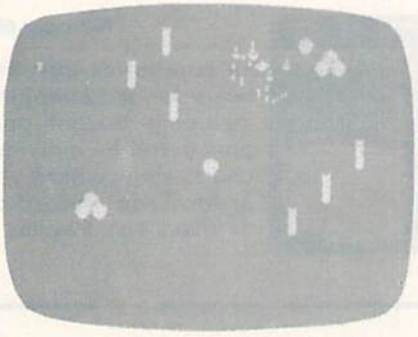

Raid over Moscow — The ultimate in multi screen computer graphics has arrived. (over six screens) The Soviets have launched an attack. First you must locate and destroy the ICBM missiles from your Stealth Bomber, then you must lead your squadron through the Soviet terrain to the Kremlin itself. Destroy the defenses, then destroy the defense center and finally the attack operations themselves. Fly planes, launch grenades, shoot bazookas. Super Fantastic Graphics, Sound, Animation. **(The best multi-level game we've seen!!!)** List $39.95. **Sale $29.95.** (Disk.) *Coupon $26.95.*

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Beach Head — Multi Screen computer graphics at its finest. First you must maneuver your fleet through the mine laden channel while torpedoes are fired at you from all sides. Next you must engage the enemy planes with your anti-aircraft guns (best scenario graphics anywhere). Then you must sink the enemy fleet before they sink you. Next you maneuver to the beach head where your tanks must get through an obstacle course and finally fight the ultimate battle at Headquarters. All scenes in stunning 3-D graphics. (Will be the best graphics of 1984, definitely).

List $39.95. **Sale $24.95.**
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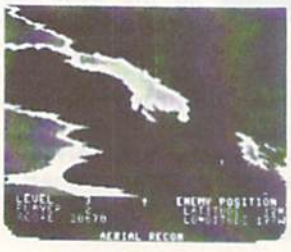
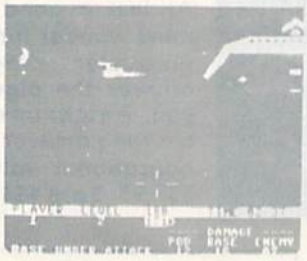


Actual Screens

Actual Screens

NEUTRAL ZONE



Neutral Zone — Reach the outer edges of the galaxy. You must protect your spaceship from attacking enemy space ships while defending yourself from enemy missiles. Fantastic 360 degree 3-D High Resolution Graphics. Rated No. 1 for graphics in 1983. List $34.95. **Sale $24.95.**(Tape or disk).

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• Official arcade version • 3-D graphics
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The famous arcade game featuring the coconut throwing gorilla, monkeys, hippos, sharks and rhinos now comes to the Commodore 64. Superb reproduction of the arcade machine challenges you to destroy the gorillas lair. List $39.95. **Sale $29.95** (cartridge).

ZAXXON

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Now the famous invasion of robot Zaxxon's lair can be done in your own home. Invade the fortress, get past the fighters then through Zaxxon's home and finally destroy Zaxxon himself. Just like the arcade game. This one's fantastic. List $39.95. **Sale $29.95** (cartridge).

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PLANET OF ZOOM

• Official arcade version • 3-D color graphics
• Four Galactic screen displays.

Just like the arcade version. Steer your ship through deadly electron posts as you fight off enemy space saucers and hoppers. Finally you meet the enemy source ship. If you get through all this you start again only this time the enemies have more powers and surprises. Fantastic graphics and sound. List $39.95. **Sale $29.95** (cartridge).

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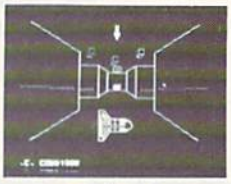


NEW

This five-screen arcade adventure packs the computer with intense graphics and sound! You are a special Cyberleague agent in a universe full of hostile aliens and vicious robots. Joystick and keyboard transport you through 3-D rooms, space barriers, fleets of invaders, and warship-ridden quadrants of space. Over 100 sprites, 8 new character sets, and dozens of mind-boggling sound effects make up this multi-layered adventure. Animation, action, and strategy all combined into a game so extensive that two disk sides are jammed with game programs and data! Reach the ultimate rank of admiral and you may carve a niche in the permanent high-score list. A full-size book quality manual with full-color covers is included to guide you through your most exciting game experience.

NEW

Perplexian Challenger

List $34.95 **Sale $24.95**

The incredibly responsive three-axis joystick control of a space fighter is in your hands. Split screen graphics provide a continuous display of your ship's instrumentation, as well as a three-dimensional, animated view of space.

You, as a pilot, must utilize lightning fast reflexes to destroy invading ships, and avoid their return fire. Simultaneously, you must maneuver your ship to capture space debris that remains from the explosions.

Outstanding graphics features include smooth 3-D rotations, split screens, and the most incredible high-resolution hyperspace sequence ever produced.

Programmed entirely in machine language, this action-strategy game is guaranteed to blow you away.

All the professional features you expect are included: automatic self-demo, high score retention, pause, and provisions for 1 to 4 players. Add to this, features you don't expect like easy-loading, and music during the load. Perplexian Challenger is a game that brings the arcade experience to your home.

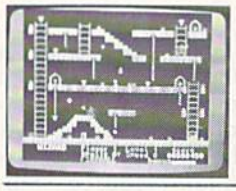
Wizard

List $49.95 **Sale $34.95**

Jump from ropes to ladders, dodge plummeting boulders and duck under deadly arrows in your quest for sparkling diamonds, gleaming bars of gold, and glistening pearls. With joystick in hand you must explore forty dazzling screens, each a new and exciting adventure. Take the key to unlock the doorway to your next spine-tingling level. Each key restores your magical powers, allowing you to cast over ten different spells. With these magic spells you have the power to overcome vicious creatures, terrifying traps, and perilous plunges.

Your Wizard is realistically animated in every possible direction. Dozens of movements are possible — jump over burning fires, shimmy up or down ropes and ladders, even slip down treacherous sliding staircases! Magic portals move your Wizard through midair and protect you from a myriad of fully-animated fiendish monsters. Catch an elevator to the top of the screen and dart through sliding gates in your quest for magic and treasure.

Wizard's fascinating variety of screens are sure to please and entertain, and of course you can build an unlimited number of your own levels using the construction set provided with your game.



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Real-time adventure excitement at its best. Solve countless puzzles and slay over a dozen monsters by using the huge vocabulary of over 200 words. Two challenging difficulty levels await you with over 80 areas, each fully described in Old English script.

Menacing monsters, kniving villains, tattered code books and treacherous terrain are just a few of the situations you must overcome in your quest for the thirteen priceless treasures. More than seventy objects are invaluable to you in your search for glory and wealth!

A full-size, thoroughly illustrated manual is included. Featuring color front and back, book quality, and a fold-out map, this "extra" further extends the professionalism of this game. The following are quotes from unsolicited testimonials sent to us by adventurers in Gothmog's Lair...

"I have extremely enjoyed Gothmog's Lair, and plan to buy more adventure games..."
Scott Tulman, Memphis, TN

"Gothmog's Lair is the best adventure I've ever played..."
Dennis Manochio, Jr., Saratoga, CA

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An in-depth self-tutorial for the Commodore 64 on a two-sided disk. This menu-driven tutorial covers every aspect of your C-64—BASIC, keyboard, sound, music, simple and advanced graphics. Quizzes test your comprehension at the end of many lessons! On-screen illustrations, sound effects and full-color interactive graphics make learning easy and interesting. The PROFESSOR is your ONLY choice for an all-in-one, thorough tutorial about the Commodore 64!

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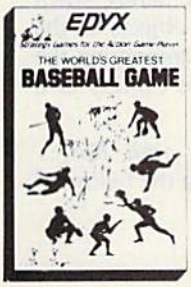

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HURRY UP!

Finally! Here is a solution to Basic's one major drawback, the lack of speed.

By William W. Braun

The more I learn about programming in Basic, the more impressed I am with its capabilities; however, it does lack speed. The time needed for the Basic interpreter in ROM to execute multiple Pokes and Peeks, during fast-action sequences, can really be a problem. You have several choices when you find your action game is just too slow.

First, you may become efficient at assembly language programming and use machine language subroutines to speed up the action. Second, you may forget fast-action animation and stick to less exciting programming. Third, you may use some or all of the following techniques to get as much speed as possible out of Basic. It can make a significant difference.

Replace numbers with variables. Programs that move objects around the screen usually have various Poke or Peek numbers involved, such as screen- or color-location numbers, or color- and character-code numbers. Many of these are used over and over again, and in each instance, Basic must take time to evaluate the number.

Assigning variables to these numbers can speed up the action, since it takes Basic less time to look up the value of a variable in its variable list than to evaluate a number it encounters in a program statement. For example:

```
POKE 7680,81:POKE38400,0
```

will place a black ball in the upper left corner of the VIC (use corresponding screen- and color-location numbers on the C-64). You can make this execute faster by using variables for the screen- and color-location and color- and character-code numbers. It would look something like this:

```
10 A=7680:B=38400:C=81:D=0
20 POKE A,C: POKE B,D
```

Initialize frequently used variables first. When Basic looks up a variable, it starts at the beginning of the variable table (the first one initialized in your program) and looks at the variables sequentially until it finds the correct one. It will locate your frequently used variables faster if you initialize them before those that are used less frequently, thus speeding up execution time. It is best first to initialize those variables that actually affect animation on the screen.

Replace lone zeroes with a period. Basic has permanently assigned 0 to the period (.). Therefore, you can speed up a program a little by using a period in place of a lone 0. This will execute even faster than a variable set equal to 0.

To speed up the short program above, simply replace the variable D in line 20 with a period. It may look a bit strange, but it does work.

Be careful not to use the period in place of *all* zeroes. For example, don't replace the zeroes in the number 3005 with periods. Only when 0 is alone can you replace it with a period.

Evaluating If...Then statements. Basic will evaluate

```
IF A=B AND IF D=E THEN 100
```

in two steps.

First it will check to see if A equals B, then it will check to see if D equals E. Since both comparisons must be true in order to branch to line 100, it isn't necessary to check if D equals E if you already know that A does not equal B.

The following structure will evaluate the second step only if the first is true, thus speeding up execution time.

```
IF A=B THEN IF D=E THEN 100
```

This can really come in handy when checking the locations of objects on the screen, as you do when comparing the positions of two or more objects at a time.

Replacing GOTO loops with For... Next loops. Take a look at the following two short programs.

Program 1

```
10 A=0
20 POKE 7680+A,A
30 A=A+1
40 IF A=60 THEN 60
50 GOTO 20
60 END
```

Program 2

```
10 FOR A=0 TO 59
20 POKE 8780+A,A
30 NEXT A
40 END
```

These two programs perform exactly the same function, but because of the way Basic works, Program 2 will execute faster than Program 1. Just remember that For...Next structures execute faster than GOTO structures.

Delete the variable after NEXT in a For...Next structure. In Program 2 above, you can speed things up a bit more by deleting the A after NEXT in line 30. Basic doesn't need it, so there's no need to waste time in evaluating it.

Put frequently used subroutines near the beginning of the program. Fast-action programs often have many subroutines—to check the joystick, to create sound effects for graphics displays or to locate objects on the screen.

When Basic looks for a subroutine, it starts looking for the proper line number at the beginning of the program. Putting your frequently used routines at the beginning of your program, with low line numbers, will hasten their execution. R

Address all author correspondence to William W. Braun, 3164 Wellington Way, Arnold, MO 63010.

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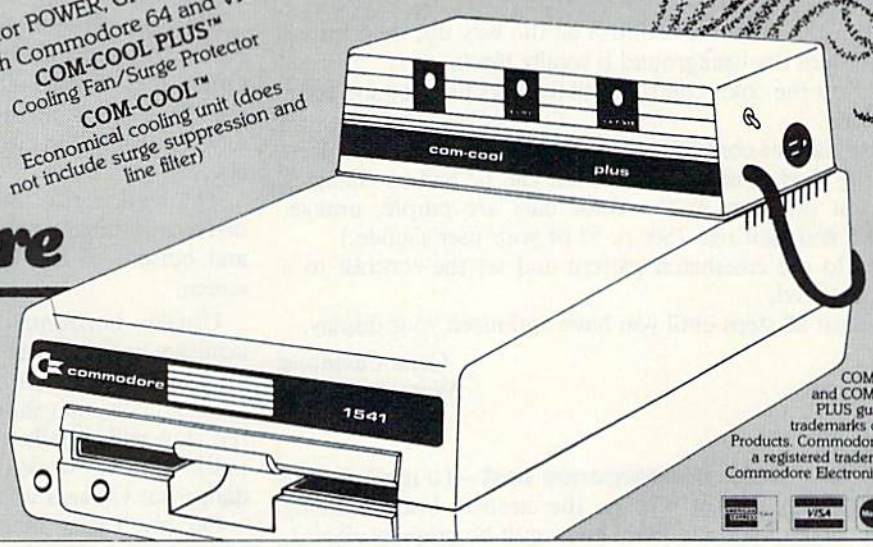

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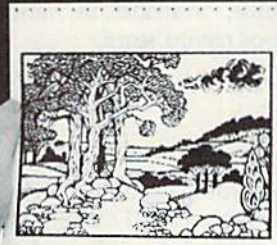

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Magic (from p. 12)

$FB Color video setup—The colors coming from your computer are very good, but the control settings on your TV or monitor can make a big difference in their appearance. To set your display correctly, follow the following procedure.

- Use the previous trick to get the vertical color bars on your screen.
- Turn the brightness control all the way up, then turn it down until the background is totally black.
- Adjust the color control until the bars have a good color intensity.
- Use the tint control to set the bars to the correct colors. On the C-64, a more sensitive test can be had by changing the test program so the color bars are purple, orange, brown and light red. (See p. 57 of your user's guide.)
- Go to the crosshatch pattern and set the contrast to a pleasing level.
- Repeat all steps until you have optimized your display.

Gene Casanova
Wauwatosa, WI

$FC Color convergence test—To maximize the definition in a color display, the electron beams coming from the red, blue and green guns must be properly aligned. The adjustments that align the beams are called static and dynamic convergence, and they should be made only by a qualified technician.

To evaluate the convergence of your own color display, you can use the Test Pattern program from the second previous trick. Put the crosshatch pattern on the screen and turn the color control all the way down. If you see a crosshatch composed of white lines, your convergence is all right. If, however, the lines are not all white, the beams are missing their targets, and your monitor needs its convergence adjusted.

By the way, the crosshatch pattern is also useful for making vertical height and linearity adjustments. These are usually found on back panel controls, and they can adjust the shape of the squares in your crosshatch pattern.

Burt Fisher
Forestdale, MA

$FD Adjusting picture size—When Commodore computers are used with certain video monitors, you see the Commodore screen area, surrounded by the Commodore border, surrounded by yet another (black) border. As a result, the usable screen display covers only a fraction of the CRT area, and the characters are much smaller than they might otherwise be. Here are the reasons for the problem, along with a suggested cure.

Displays for TV viewing are adjusted so the outer edges of the picture slightly overlap the edge of the CRT. This is called overscanning, and it's done to gain certain technical benefits; losing part of the picture is the price you pay to gain them. Since losing your screen data to overscan would be unacceptable, Commodore's border keeps the outer screen columns well *in*side the edge of the picture.

But monitors made for text displays do *not* overscan. In fact, they *underscan*, to make sure that no character is ever lost. When you put a Commodore signal into such a monitor, you get more borders than you bargained for—Commodore's overscan-protective border, plus the CRT's underscanned outer edges.

Correcting the problem is simple in many cases. Some high-quality monitors are designed for TV *and* data use, with a size switch on the back panel; just set it properly, and the problem will go away.

Most other monitors have a vertical size control on the back panel and a horizontal size control inside the cabinet. Often, these can be adjusted so the useful screen area fills the CRT. Adjusting them is simple and straightforward for anyone qualified in electronics, but dangerous for everyone else.

The vertical size, or height, control is usually a screwdriver-adjustable potentiometer; just turn it until the top and bottom of the black border move outward off the screen.

Usually, horizontal size, or width, is controlled by an iron slug in a coil near the high-voltage flyback transformer; it may or may not be labeled. If it isn't, your monitor's schematic diagram should help you identify it. Unscrewing the slug will usually expand the picture; don't touch it unless you've worked inside a TV before—there are dangerous voltages *very* close by.

On my Taxan monitor, I removed the slug entirely, which brought the Commodore border just to the edge of the screen. Replacing the iron slug with a brass one moved it even further outward.

If your monitor dealer has a repair department, they should be willing to make both adjustments for you, and to guarantee their work. If you make them yourself, you do so at your own risk, but your actions are unlikely to harm your equipment.

Pat Baker
McKeesport, PA

$FE Video video—There are times when you might want to connect your computer to two monitors at the same time, to allow simultaneous monitoring in color and black and white, or to monitor a program remotely.

To accomplish this, just insert a phono-plug-to-two-phono-jacks adapter (Radio Shack #42-2436 or #274-303) into the TV connector on your computer or monitor. You'll also need an additional video cable and possibly another computer/TV switch. Note that the video cable is simply an ordinary phono cable, available in various lengths from virtually any music or record store.

David M. Palo
Escanaba, MI

$FF Video shortcut—If you have both a VIC-20 and a C-64, along with Commodore's 1701/1702 monitor, and are tired of plugging and unplugging the audio and video cables, try the following.

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into the rear panel set of jacks (with a three-wire cable) and the VIC into the front panel set of jacks (with a two-wire cable). Use the tiny slide switch on the rear panel of the monitor to switch between the two computers.

Karl T. Thurber, Jr.
Millbrook, AL

$100 80-column video—If you're thinking of buying an 80-column screen expander, be prepared to buy a monochrome monitor as well. Most TVs and color monitors can't display anything more detailed than a 40-column text display, and some of them are hard pressed to do even that. So even if your cartridge puts out perfect 80-column video, your color display probably won't do it justice.

Monochrome monitors generally cost from $100–$175 and are specifically designed to have the resolution that an 80-column display requires. The choice of green, amber or white screen is left to your personal preference. Few monochrome monitors include a speaker, so be careful if you intend to use sound with your 80-column text.

Troy Johnson
Milwaukee, WI

$101 TV color filter—If looking at a black and white monitor gives you eyestrain, put colored cellophane or plastic wrap over the screen. The kind that is used for gift wrapping or Easter baskets works fine and is very inexpensive. Green, blue or yellow seems to work the best.

Carol Forbey
Flint, MI

$102 C-64 sideways screen scroll—This works, and it is slick. Under some conditions, resetting the screen links will make it even slicker. Put something on the screen, then run:

```
100 FOR I=1 TO 40 : PRINT"{HOME}{CRSR RT}";:FOR J=1 TO
  24:PRINT""{CRSR LF}{3 SHFT HOME}{DEL}{CRSR DN}
  {CRSR RT}";:NEXTJ,I
```

The strange sequence after the second Print statement is required to properly control the Quote mode; it must be performed *exactly* as shown, and if you hit the wrong key, you must start all over. After your keyboard magic is done, the line will list differently than it was typed, and it *cannot* be edited.

Eric the Juggler
Pittsburgh, PA

$103 Resetting screen links—If you've ever drawn fancy boxes or displays that extend to the edge of your screen, you've noticed that it seems impossible to print inside that box or display. The reason is that the operating system remembers which line overlapped the 40-column screen and prevents the normal Print statements from putting anything on that line. Frustrating!

The easy solution is to reset the screen links once the initial fancy graphics are printed. Call the following subroutine, and you'll be able to print anything on any line.

```
1010 FOR Q=217 TO 242
1020 IF PEEK(Q)<128 THEN POKE Q, PEEK(Q)+128
1030 NEXT:RETURN
```

The above Basic routine works well but is somewhat slow. If you want to speed things up, use the following machine language version. After running the Basic loader, you can call the relinker at any time by entering SYS 830.

```
1000 FOR J=830 TO 843:READA:POKEJ,A:NEXT
1010 DATA 162,0,181,217,9,128,149
1020 DATA 217,232,224,25,208,245,96
```

Bruce Jaeger
St. Paul, MN

$104 Screen blanking—To slightly speed up your C-64, you can make the screen turn blank when it is not needed. When the screen turns blank, it appears to be the same color as the border. To do this, enter:

```
POKE 53265,PEEK(53265) AND 239
```

To return it to normal, enter:

```
POKE 53265,PEEK(53265) OR 16
```

Pressing the stop and restore keys will also return the screen to normal. While the screen is blank, it can still be written to, but the writing will be invisible. The timesaving while the screen is blank can vary from almost nothing to over ten percent, so it's worth considering whenever time is a factor.

Mark Mankins
Malvern, OH

$105 Setting color memory—To set the C-64's color memory to a particular color, you may see something like this being done:

```
POKE53281,X:PRINT"{SHFT CLR}":FORI=55296TO56295:
POKEI,Y:NEXT
```

where X is the screen color and Y is the desired color for Poked characters.

But when you clear the screen, the computer resets all of color memory to the current screen color. With this in mind, the following routine will give the same result as the one above.

```
POKE53281,Y : PRINT"{SHFT CLR}" : POKE53281,X
```

Color memory will be set to Y, and the blank screen will be the color X. This routine takes about four jiffies on the C-64, saving several seconds over the other method.

You'll notice a little flicker when the screen is cleared, and if it bothers you, there's a simple way around it. Just turn off the display before initializing color memory, using

```
POKE 53265,PEEK(53265) AND NOT 16
```

Turn it back on afterwards with:

```
POKE 53265,PEEK(53265) OR 16
```

The result will be a fast, invisible setup of every location in color memory.

Michael McGuire
Gardner, KS

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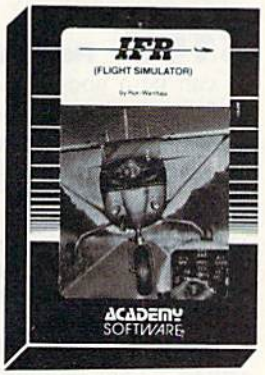

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$106 Screen Pokes simplified—The numbers used here are for the Commodore 64 but the idea is applicable to the VIC-20 as well.

When writing a program that uses graphics Poked to the screen, you normally Poke the screen memory location with the character code and then Poke the color memory location with the color code.

For instance, the following program lines put a white ball in the upper left-hand corner of the screen and a red ball in the lower right-hand corner.

```
50 POKE 1024,81:POKE 55296,1
60 POKE 2023,81:POKE 56295,2
```

This process requires you to calculate both the screen and color memory locations.

To make this programming task simpler, at the beginning of each program I set a variable equal to the difference between color memory and screen memory (54272). This difference is the same for any screen location. The following example gives the same result as above.

```
10 CO = 54272

50 POKE 1024,81:POKE 1024 + CO,1
60 POKE 2023,81:POKE 2023 + CO,2
```

Here you must only deal with the screen memory map and can totally forget about the color memory map.

54272 is also the start of the C-64's sound locations, so this variable can be used in music routines as well.

Barbara H. Schulak
Iowa City, IA

$107 Renumbering hint—A renumbering utility can be a godsend, but when you renumber, you lose track of the starting lines of your program's various parts. You can find them again if you put dummy lines, like the following, at the end of your program.

```
63950 END
63952 GOTO 1000 : REM START SUBS
63954 GOTO 2000 : REM PRINT MENU
63956 GOTO 3000 : CALCULATE TOTAL
```

The End statement prevents these lines from being executed. The renumbering automatically changes the GOTOs, so when you examine these lines, you'll know where everything is. If you've put these lines at the end of the program, examining them should be a snap.

Terry Neely
Norcross, GA

$108 Debugging tip—If you're getting a Syntax error from a multi-statement line, but you can't find your error, put a dummy Print statement after each statement on the line. If the Print statement works, you know that the error must lie after it. Once you've found the error, you can remove the dummy Print statements.

A. Lubin
Monsey, NY

$109 Engineering notation—Sometimes it is convenient to express numbers in engineering notation (not scientific notation). In this notation, the mantissa is between 1 and 1000, and the exponent is always displayed in multiples of 3, so the units of measure are easily read. For example: E – 6 = micro, E3 = kilo, E6 = mega and so on. Below is a routine that displays any number X in engineering notation.

```
9000 IF X = 0 THEN E = 0:M = 0:GOTO 9030
9010 Z = LOG(ABS(X))/LOG(10):E = INT(Z):M = 10↑(Z + INT(Z))
9020 IF E/3 < > INT(E/3) THEN E = E – 1: M = M*10:GOTO 9020
9030 M = M*SGN(X):PRINT M;"E";E
```

To test this routine, add this statement:

```
10 INPUT "X = ";X
```

For example: 0.00137 becomes 1.37E – 3, as in milli(grams), and 6.25E – 7 becomes 625E – 9, as in nano-(seconds).

Imre Auersbacher
Belleville, NJ

$10A Software reset button—Do you need a reset button for your C-64 or VIC-20 but don't have the money to buy the hardware? Good news—you can have one absolutely free! To use the restore key as the reset button, do the following.

```
POKE 792, PEEK(65532)
POKE 793, PEEK(65533)
```

This establishes the NMI vector in RAM to be the same as the reset vector. The only drawback is that as soon as you use the restore key as the reset button, the NMI vector gets restored. So, after every use, perform the two Pokes again to reestablish the restore key as the reset button.

Bobby G. Roberts
North Highlands, CA

$10B Stack pointer—To determine the stack pointer's position from Basic, enter:

```
POKE 2,96 : SYS 2 : SP = PEEK(783)
```

The Poke command puts an RTS where you can get at it, SYS 2 executes the RTS and 783 will then hold the stack pointer. The variable SP will hold it, too.

Eric Haver
Squirrel Hill, PA

$10C Buck writing—On many occasions I have wanted to print dollars and cents, rounded to the nearest cent, with two decimal places. The following one line, added to a program, does it, except for negative numbers:

```
10 V = INT((V + .005)*100):V = (V + .1)/100:V$ = STR$(V):V$ = LEFT$
   (V$,LEN(V$) – 1)
```

where V = the original value and V$ = the string representation of the value.

When you print the variable V$, any value of V will be printed with two decimal places, rounded to the nearest cent.

Alfred G. Swenson
Renton, WA

$10D More buck writing—This one handles negative numbers, but fails on items less than a dime.

```
20 V=INT(V*100+.001):V$=STR$(V):V$="$"+LEFT$(V$,LEN
   (V$)-2)+"."+RIGHT$(V$,2)
```

To print the output in a neat column, use:

```
Q=LEN(V$):PRINT TAB(20-Q)V$
```

The 20 in this line is the position of the last character in V$.

Marilyn Sallee
Alliance, NE

$10E Still more buck writing—This one handles everything; with four times as many lines, it *should*.

```
100 IF X<.005 AND X>-.005 THEN X$="$ 0.00":GOTO 140
110 X=X+.005*SGN(X):X$=STR$(X)
120 FOR I=1 TO LEN(X$):IF MID$(X$,I,1)="."THEN X$=
    "$"+LEFT$(X$,I+2):GOTO 140
130 NEXT:X$="$"+X$+".00":GOTO 140
140 PRINT X$
```

Kevin O'Connor
Union, NJ

$10F Homemade fanfold—When we want to use a few sheets of special paper in our printer, we sometimes tape them together like fanfold, so we don't have to stop printing at the end of each sheet. Finding a tape that was thin and tenacious enough to do the job but that wouldn't tear the paper when removed wasn't an easy task, but we did it. The perfect printer tape is the pink hair-setting tape that's available in any Health and Beauty Aids department.

Dion and Carlos
New York, NY

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J. Besoin-d'Argent
Paris

$111 Cassette tip—It is advantageous to leave a space of about 10 counts between programs on your tape. This way, you can add something to any program without having it overwrite the program that follows it on the tape.

A. Lubin
Monsey, NY

[R]

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(from p. 32)

vanquish that invader, GEO$(R,2), is stored in INVADER$(n,2).

The current row in which each invader is printed is stored in a numeric array with three elements, one for each of the three invaders. At the start of a round, R(1), R(2) and R(3) will all equal 1, because invaders 1, 2 and 3 will start in row 1.

As the round progresses, the Locate statement is used to position the cursor in the column and row in which an invader is to appear. To print invader Q, use the following lines.

```
930 PRINT LEFT$(R$,COL(Q));
940 PRINT LEFT$(D$,R(Q));
950 FOR S=1 TO LEN(INVADER$(Q,1))
960 PRINT CHR$(32);
970 NEXT S
980 R(Q)=R(Q)+1
990 PRINT LEFT$(R$,COL(Q));LEFT$(D$,R
    (Q));
1000 PRINT INVADER$(Q,1);
```

COL(n), you will remember, always remains the same for each invader. So, line 930 locates the cursor at the fixed column for invader Q. Then, line 940 moves the cursor to the correct row.

Next, a For...Next loop, from 1 to the length of the invader's name, prints a series of spaces, CHR$(32), on the screen, in order to erase the invader at the last position in which it appeared. Next, you add 1 to the row in which invader Q appears and print the invader word in the new location.

Because Q is chosen at random (line 900 in the Commodore 64 listing, 910 in the VIC-20), sometimes one invader will move several times in a row while the others remain still. Other times the movement will be more equal. The result is the random descent of the three alien words.

If any of the three R(n) variables equal the number of lines that can be displayed by the Commodore 64 or VIC-20, then the invader has reached the last row of the screen, and the program accesses a subroutine that subtracts a life and signals with a sound and printed warning. This module also checks to see if LIVES=0, and, if so, ends the game.

```
1330 RIGHT=RIGHT+1
1340 PRINT CL$
1350 GOSUB 1660
1360 GOSUB 770
1370 INVADER$(AN,1)=GEO$(R,1):INVADER$(AN,2)=GEO$(R,2)
1380 GEO$(R,1)=""
1390 R(1)=1:R(2)=1:R(3)=1
1400 AN$=""
1410 RETURN
1420 REM *** GAME IS LOST ***
1430 PRINT CL$;DN$;DN$
1440 PRINT TAB(4)"SORRY, BUT ALL YOUR LIVES"
1450 PRINT TAB(4)"ARE GONE.{2 SPACEs}YOU DID GET ";RIGH
     T
1460 PRINT TAB(4)"ANSWERS CORRECT."
1470 PRINT
1480 GOTO 1540
1490 REM *** GAME IS WON ***
1500 PRINT CL$;DN$;DN$
1510 PRINT TAB(10)"YOU HAVE WON!"
1520 PRINT
1530 REM *** PLAY AGAIN ***
1540 PRINT TAB(10)"PLAY AGAIN?"
1550 GET A$:IF A$="" GOTO 1550
1560 IF A$="Y" THEN RUN
1570 END
1580 R$=HME$
1590 FOR COL=1 TO 40
1600 R$=R$+RT$
1610 NEXT COL
1620 FOR ROW=1 TO 25
1630 D$=D$+DN$
1640 NEXT ROW
1650 RETURN
1660 PRINT LEFT$(R$,1);LEFT$(D$,25);
1670 FOR B=1 TO 39
1680 C=((INT(RND(1)*3)+1)*10)+152
1690 PRINT CHR$(C);
1700 NEXT B
1710 RETURN
1720 FOR N=15 TO 14 STEP-1
1730 POKE 54296,N
1740 POKE 54276,129
1750 POKE 54277,15
1760 POKE 54273,40
1770 POKE 54272,200
1780 NEXT N
1790 POKE 54276,0
1800 POKE 54277,0
1810 RETURN
1820 POKE 54296,15
1830 POKE 54276,33
1840 POKE 54277,128
1850 POKE 54278,128
1860 FOR J=1 TO 2
1870 FOR N=1 TO 100
1880 POKE 54273,N/2+30
1890 POKE 54272,N/2+70
1900 NEXT N
1910 NEXT J
1920 POKE 54296,0
1930 RETURN
```

Listing 2. Geography Invaders program for the VIC-20 with 3K expansion.

```
10 REM ************
20 REM *{11 SPACEs}*
30 REM * GEOGRAPHY *
40 REM *{2 SPACEs}INVADERS *
```

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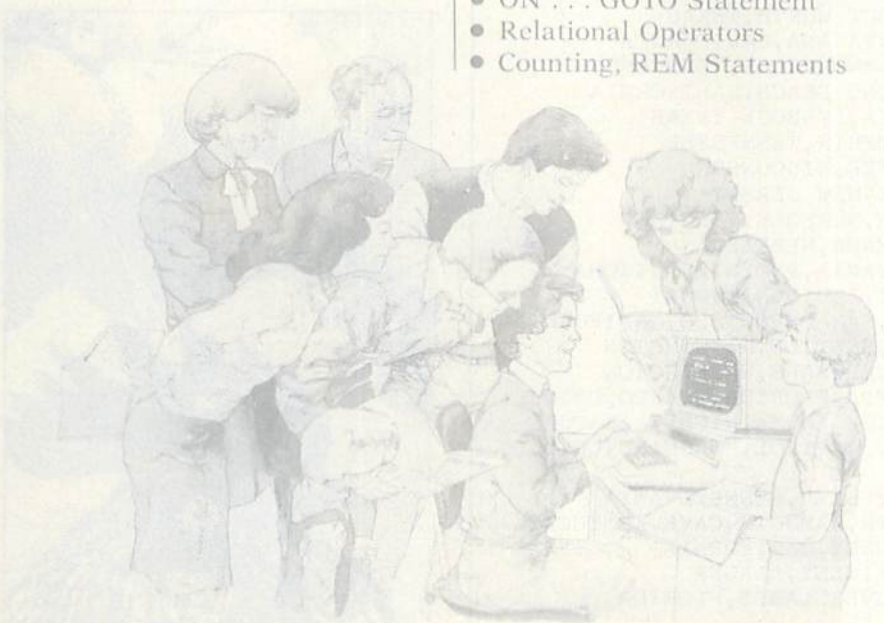

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Listing 2 continued.

```
5Ø REM *{11 SPACEs}*
6Ø REM ************
7Ø REM *** INITIALIZE ***
8Ø CL$=CHR$(147):DN$=CHR$(17)
9Ø RT$=CHR$(29):HME$=CHR$(19)
1ØØ LF$=CHR$(157):UP$=CHR$(145)
11Ø RV$=CHR$(18):OFF$=CHR$(146)
12Ø WHITE$=CHR$(5):CYAN$=CHR$(159)
13Ø GOSUB 158Ø
14Ø NC=65
15Ø LIVES=3
16Ø REM *** INSTRUCTIONS ***
17Ø PRINT CL$;DN$
18Ø PRINT"* GEOGRAPHY INVADERS *";DN$
19Ø PRINT TAB(2)"ENTER THE STATE IN"
2ØØ PRINT TAB(2)"WHICH THE GEOGRAPHY"
21Ø PRINT TAB(1)CHR$(34);"INVADER";CHR$(34);" IS LOCATE
    D.";DN$
22Ø PRINT TAB(2)"YOU HAVE 3 LIVES"
23Ø PRINT TAB(2)"IN WHICH TO TRY"
24Ø PRINT TAB(2)"TO KILL 25 INVADERS.";DN$
25Ø PRINT TAB(3)"== HIT ANY KEY =="
26Ø GET A$:IF A$="" GOTO 26Ø
27Ø REM *** ENTER DIFFICULTY ***
28Ø PRINT CL$;DN$;DN$
29Ø PRINT "ENTER DIFFICULTY:";DN$
3ØØ PRINT "[1] FAST TO [9] SLOW"
31Ø GET A$:IF A$="" GOTO 31Ø
32Ø DELAY=VAL(A$)*2
33Ø IF DELAY=Ø GOTO 31Ø
34Ø REM *** READ STATES, SITES INTO ARRAY ***
35Ø PRINT CL$
36Ø COL(1)=1:COL(2)=6:COL(3)=11
37Ø DIM GEO$(NC,2)
38Ø FOR ROW=1 TO NC
39Ø FOR COL=1 TO 2
4ØØ READ GEO$(ROW,COL)
41Ø NEXT COL
42Ø NEXT ROW
43Ø PRINT CL$
44Ø REM *** GEOGRAPHIC INFORMATION ***
45Ø DATA AKRON,OHIO,ALBUQUERQUE,NEW MEXICO
46Ø DATA ANAHEIM,CALIFORNIA,ANCHORAGE,ALASKA
47Ø DATA BALTIMORE,MARYLAND,BUFFALO,NEW YORK
48Ø DATA CHARLOTTE,NORTH CAROLINA,CHICAGO,ILLINOIS
49Ø DATA CORPUS CHRISTI,TEXAS,DALLAS,TEXAS
5ØØ DATA DAYTON,OHIO,DETROIT,MICHIGAN,EL PASO,TEXAS
51Ø DATA FORT WAYNE,INDIANA,FORT WORTH,TEXAS
52Ø DATA FRESNO,CALIFORNIA,SANTA ANA,CALIFORNIA
53Ø DATA JACKSONVILLE,FLORIDA,KNOXVILLE,TENNESSEE
54Ø DATA LEXINGTON,KENTUCKY,LONG BEACH,CALIFORNIA
55Ø DATA LOS ANGELES,CALIFORNIA,LUBBOCK,TEXAS
56Ø DATA MADISON,WISCONSIN,MEMPHIS,TENNESSEE
57Ø DATA MIAMI,FLORIDA,MILWAUKEE,WISCONSIN
58Ø DATA MOBILE,ALABAMA,NEWARK,NEW JERSEY
59Ø DATA NEW ORLEANS,LOUISIANA,NORFOLK,VIRGINIA
6ØØ DATA OAKLAND,CALIFORNIA,OMAHA,NEBRASKA
61Ø DATA PHILADELPHIA,PENNSYLVANIA,PHOENIX,ARIZONA
62Ø DATA PORTLAND,OREGON,SAINT LOUIS,MISSOURI
63Ø DATA SAN DIEGO,CALIFORNIA,SAN FRANCISCO,CALIFORNIA
64Ø DATA SANTA ANA,CALIFORNIA,SEATTLE,WASHINGTON
65Ø DATA SHREVEPORT,LOUISIANA,SPOKANE,WASHINGTON
66Ø DATA SYRACUSE,NEW YORK,TAMPA,FLORIDA,TOLEDO,OHIO
67Ø DATA TUCSON,ARIZONA,TULSA,OKLAHOMA,WICHITA,KANSAS
68Ø DATA YONKERS,NEW YORK,U.S. CAPITOL,"WASHINGTON,D.C.
    "
69Ø DATA TAMPA,FLORIDA,LIBERTY BELL,PENNSYLVANIA
7ØØ DATA PLYMOUTH,MASSACHUSETTS,MAMMOTH CAVE,KENTUCKY
71Ø DATA ALAMO,TEXAS,DEATH VALLEY,CALIFORNIA
72Ø DATA SALT LAKE,UTAH,MT MCKINLEY,ALASKA
73Ø DATA CARLSBAD,NEW MEXICO,EVERGLADES,FLORIDA
```

More

As the aliens descend, the keyboard looks for input (lines 910 and 920). If you press a key, the program jumps to line 1150 or 1160. There, a check is first made to see if A$ was RETURN (CHR$ (13)). If it was, the program moves again, this time to lines 1250–1260, to see if the answer, AN$, equals any of the proper responses to the invaders currently on the screen.

Any correct response will move the program one more time, to where you'll be informed of the correct answer. Then, the invaders' old positions are erased, their rows returned to a value of 1 and a new invader is chosen to replace the one correctly answered.

You'll notice that the names of the places overlap each other on the screen. This is especially the case with the VIC-20, which has a narrower screen in the first place. Where possible, I've changed a few of the place names in the VIC-20 listing, to keep the invaders from wrapping around.

However, because the names overlap, it adds to the fun, because sometimes you're unable to see a threatening word until it moves again.

If you'd like to modify this program, try substituting names of your own choice, or try to find a way to make sure the place name is always visible. R

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Listing 2 continued.

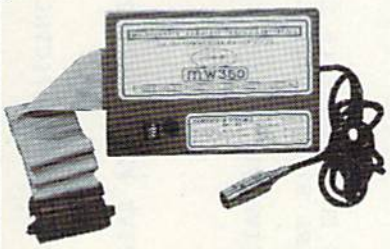
```
74Ø DATA EMPIRE STATE,NEW YORK,DISNEYLAND,CALIFORNIA
75Ø DATA NIAGARA,NEW YORK,GR CANYON,ARIZONA
76Ø DATA SEARS TOWER,ILLINOIS
77Ø GOTO 82Ø
78Ø R=INT(RND(1)*NC)+1
79Ø IF GEO$(R,1)="" GOTO 78Ø
8ØØ RETURN
81Ø REM *** SET UP THREE INVADERS ***
82Ø FOR N=1 TO 3
83Ø GOSUB 78Ø
84Ø INVADER$(N,1)=GEO$(R,1):INVADER$(N,2)=GEO$(R,2)
85Ø GEO$(R,1)=""
86Ø NEXT N
87Ø REM *** START ROUND, MOVE INVADERS ***
88Ø PRINT CL$
89Ø GOSUB 166Ø
9ØØ R(1)=1:R(2)=1:R(3)=1
91Ø Q=INT(RND(1)*3)+1
92Ø GET A$:IF A$<>"" THEN GOSUB 117Ø
93Ø IF R(1)=23 OR R(2)=23 OR R(3)=23 THEN GOSUB 1Ø6Ø
94Ø PRINT LEFT$(R$,COL(Q));
95Ø PRINT LEFT$(D$,R(Q));
96Ø FOR S=1 TO LEN(INVADER$(Q,1))
97Ø PRINT CHR$(32);
98Ø NEXT S
99Ø R(Q)=R(Q)+1
1ØØØ PRINT LEFT$(R$,COL(Q));LEFT$(D$,R(Q));
1Ø1Ø PRINT INVADER$(Q,1);
1Ø2Ø GOSUB 172Ø
1Ø3Ø FOR N=1 TO DELAY:NEXT N
1Ø4Ø GOTO 91Ø
1Ø5Ø REM *** INVADER REACHED GROUND ***
1Ø6Ø PRINT CL$
1Ø7Ø PRINT "YOU HAVE LOST A ";
1Ø8Ø PRINT "LIFE, CARELESS HUMAN!"
1Ø9Ø GOSUB 172Ø
11ØØ FOR N=1 TO 1ØØØ:NEXT N
111Ø PRINT CL$
112Ø GOSUB 166Ø
113Ø LIVES=LIVES-1
114Ø IF LIVES=Ø GOTO 145Ø
115Ø R(1)=1:R(2)=1:R(3)=1:GOTO 142Ø
116Ø REM *** LETTER IS ENTERED ***
117Ø IF A$=CHR$(13) THEN GOTO 127Ø
118Ø IF A$=CHR$(32) THEN GOTO 121Ø
119Ø A=ASC(A$)
12ØØ IF A<65 OR A>9Ø THEN RETURN
121Ø AN$=AN$+A$
122Ø PRINT HME$;
123Ø PRINT AN$;
124Ø PRINT TAB(12)RV$;WHITE$;"LIVES :";OFF$;CYAN$;LIVES
     ;
125Ø RETURN
126Ø REM *** CHECK ANSWER ***
127Ø IF RIGHT>13 THEN GOTO 151Ø
128Ø IF AN$=INVADER$(1,2) THEN AN=1:GOTO 135Ø
129Ø IF AN$=INVADER$(2,2) THEN AN=2:GOTO 135Ø
13ØØ IF AN$=INVADER$(3,2) THEN AN=3:GOTO 135Ø
131Ø AN$=""
132Ø PRINT HME$;"{17 SPACEs}";:PRINT HME$;
133Ø RETURN
134Ø REM *** CORRECT ANSWER ***
135Ø RIGHT=RIGHT+1
136Ø PRINT CL$
137Ø GOSUB 166Ø
138Ø GOSUB 78Ø
139Ø INVADER$(AN,1)=GEO$(R,1):INVADER$(AN,2)=GEO$(R,2)
14ØØ GEO$(R,1)=""
141Ø R(1)=1:R(2)=1:R(3)=1
142Ø AN$=""
143Ø RETURN
```

More

Listing 2 continued.

```
144Ø REM *** GAME IS LOST ***
145Ø PRINT CL$;DN$;DN$
146Ø PRINT "SORRY, ALL YOUR LIVES"
147Ø PRINT "ARE GONE.{2 SPACEs}YOU GOT ";RIGHT
148Ø PRINT "ANSWERS CORRECT.";DN$
149Ø GOTO 154Ø
15ØØ REM *** GAME IS WON ***
151Ø PRINT CL$;DN$;DN$
152Ø PRINT "YOU HAVE WON!";DN$
153Ø REM *** PLAY AGAIN ***
154Ø PRINT TAB(1Ø)"PLAY AGAIN?"
155Ø GET A$:IF A$="" GOTO 155Ø
156Ø IF A$="Y" THEN RUN
157Ø END
158Ø R$=HME$
159Ø FOR COL=1 TO 4Ø
16ØØ R$=R$+RT$
161Ø NEXT COL
162Ø FOR ROW=1 TO 25
163Ø D$=D$+DN$
164Ø NEXT ROW
165Ø RETURN
166Ø PRINT LEFT$(R$,1);LEFT$(D$,23);
167Ø FOR B=1 TO 21
168Ø C=((INT(RND(1)*3)+1)*1Ø)+152
169Ø PRINT CHR$(C);
17ØØ NEXT B
171Ø RETURN
172Ø POKE 36878,15          174Ø POKE 36878,Ø
173Ø POKE 36874,23Ø         175Ø RETURN
```


Circle 177 on Reader Service card.



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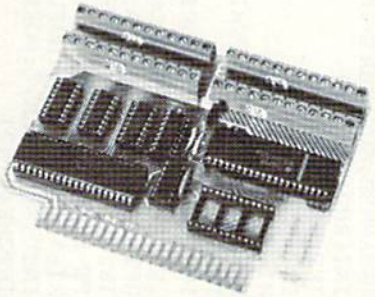

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```
 74Ø IFTP2=15Ø2ORTP2=15Ø7ORTP2=1526ORTP2=1861ORTP2=1788O
     RTP2=1966THENGOSUB161Ø
 75Ø IFD=1THEN78Ø
 76Ø IFPL=2THENPL=1:GOTO78Ø
 77Ø IFPL=1THENPL=2
 78Ø GOSUB154Ø:GOTO2Ø8Ø
 79Ø IFPL=1THEN3Ø
 8ØØ PL=2:PO=TP2:TK=94:JP=56321
 81Ø GOTO5Ø
 82Ø S=54272:FORE=STOS+28:POKEE,Ø:NEXT
 83Ø POKE54296,12:POKE54277,85:POKE54278,197
 84Ø POKE54276,33:POKE54273,1:POKE54272,25Ø
 85Ø FORT=1TO1ØØ:NEXT:POKE54276,128:FORT=1TO1Ø:NEXT
 86Ø RETURN
 87Ø FORP=1TO5:READP$(P):NEXT
 88Ø FORR=1TO6:READR$(R):NEXT
 89Ø FORW=1TO5:READW$(W):NEXT
 9ØØ DATA MRS.LANE,STEPSON,BUTLER,MAID,MISTRESS
 91Ø DATALIBRARY,LIVING RM,DEN,KITCHEN,LOUNGE,STUDY
 92Ø DATAHAMMER,GUN,CHAIN,KNIFE,POISON
 93Ø P=INT(RND(Ø)*5)+1
 94Ø R=INT(RND(Ø)*6)+1
 95Ø W=INT(RND(Ø)*5)+1
 96Ø FORT=1TO1ØØ:NEXT
 97Ø IFRE=1THENRESTORE:FORI=1TO16:READDD$:NEXT:GOTO114Ø
 98Ø RETURN
 99Ø PRINT"{SHFT CLR}";CHR$(14):POKE5328Ø,1:POKE53281,1
1ØØØ PRINTTAB(9)"{5 CRSR DNs}{CTRL 1}{SHFT M}YSTERY OF
     {SHFT L}ANE {SHFT M}ANOR"
1Ø1Ø PRINT:PRINTTAB(12)"{CRSR DN}{SHFT B}Y {SHFT J}IM {
     SHFT S}ANDERS"
1Ø2Ø FORT=1TO13ØØ:NEXT:GOSUB87Ø
1Ø3Ø PRINT"{SHFT CLR}":POKE53281,6:POKE5328Ø,6
1Ø4Ø PRINTCHR$(142)
1Ø5Ø PRINT"{CRSR RT}{2 CRSR DNs}{CTRL 2}HOW MANY WILL W
     ORK ON THIS CASE 1 OR 2"
1Ø6Ø GETD:IFD<1ORD>2THEN1Ø6Ø
1Ø7Ø PRINT"{CRSR RT}{2 CRSR DNs}PLEASE ENTER NAMES(6 LE
     TTERS MAX) THEN{2 SPACEs}PUSH {CTRL 9}RETURN{CTRL
     Ø}"
1Ø8Ø INPUT"{CRSR DN}{6 CRSR RTs}DETECTIVE #1";D1$:IFD1$
     =""THEN1Ø8Ø
1Ø9Ø IFD=2THEN112Ø
11ØØ GOSUB294Ø
111Ø IFD=1THEN114Ø
112Ø INPUT"{CRSR DN}{6 CRSR RTs}DETECTIVE #2";D2$:IFD2$
     =""THEN112Ø
113Ø GOSUB294Ø
114Ø POKE53265,PEEK(53265)AND239:PRINT"{SHFT CLR}{CTRL
     2}":POKE53281,Ø:POKE5328Ø,14
115Ø FORI=1Ø24TO1Ø63:POKEI,99:NEXT
116Ø FORI=1Ø63TO1423STEP4Ø:POKEI,1Ø6:NEXT
117Ø FORI=1Ø24TO1384STEP4Ø:POKEI,116:NEXT
118Ø FORI=1384TO1423:POKEI,1ØØ:NEXT
119Ø FORI=1Ø43TO1323STEP4Ø:POKEI,1Ø6:NEXT
12ØØ FORI=1Ø44TO1324STEP4Ø:POKEI,116:NEXT
121Ø PRINTTAB(12)"{2 CRSR DNs}{CTRL 8}PUSH"
122Ø PRINTTAB(8)"{CTRL 9}J{CTRL Ø}STK BUTTON"
123Ø PRINTTAB(11)"TO STOP"
124Ø PRINTTAB(1Ø)"STEP-GEN."
125Ø PRINT"{HOME}";TAB(16)"{8 CRSR DNs}{CTRL 9}{COMD 8}
     12345678"
126Ø FORI=1425TO1462:POKEI,1ØØ:NEXT:FORI=1985TO2Ø22:POK
     EI,99:NEXT
127Ø FORI=15Ø3TO1983STEP4Ø:POKEI,116:NEXT:FORI=1464TO19
     44STEP4Ø:POKEI,1Ø6:NEXT
128Ø TI$="ØØØØØØ"
129Ø PRINT"{HOME}{11 CRSR DNs}{CRSR RT}{CTRL 9}{COMD 5}
     {13 SPACEs}{CTRL 3}{4 SPACEs}{CTRL 1}{COMD +}{CTRL
      6}{1Ø SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{C
     TRL 1}{COMD +}{CTRL 8}{5 SPACEs}"
13ØØ PRINT"{CRSR RT}{CTRL 9}{COMD 5}{13 SPACEs}{CTRL 3}
     {4 SPACEs}{CTRL 1}{COMD +}{CTRL 6}{1Ø SPACEs}{CTRL
      1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL 1}{COMD +}{CTRL
      8}{5 SPACEs}"
131Ø PRINT"{CRSR RT}{CTRL 9}{COMD 5}{12 SPACEs}{CTRL 1}
     {COMD +}{CTRL 3}{4 SPACEs}{CTRL 1}{COMD +}{CTRL 6}
     {1Ø SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL
      1}{COMD +}{CTRL 8}{5 SPACEs}"
132Ø PRINT"{CRSR RT}{CTRL 9}{COMD 5}{12 SPACEs}{CTRL 1}
     {COMD +}{CTRL 3}{4 SPACEs}{CTRL 1}{COMD +}{CTRL 6}
     {1Ø SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL
      1}{COMD +}{CTRL 8}{5 SPACEs}"
133Ø PRINT"{CRSR RT}{CTRL 9}{CTRL 1}{7 COMD +s}{COMD 5}
     {3 SPACEs}{CTRL 1}{3 COMD +s}{CTRL 3}{4 SPACEs}{CT
     RL 1}{6 COMD +s}{CTRL 6}{3 SPACEs}{CTRL 1}{3 COMD
     +s}{CTRL 3}{3 SPACEs}{CTRL 1}{4 COMD +s}{CTRL 8}{2
      SPACEs}"
134Ø PRINT"{CRSR RT}{CTRL 9}{CTRL 3}{38 SPACEs}"
135Ø PRINT"{CRSR RT}{CTRL 9}{CTRL 3}{38 SPACEs}"
136Ø PRINT"{CRSR RT}{CTRL 9}{CTRL 1}{7 COMD +s}{COMD 8}
     {3 SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL
     1}{3 COMD +s}{CTRL 5}{2 SPACEs}{CTRL 1}{4 COMD +s}
     {CTRL 5}{2 SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACE
     s}{CTRL 1}{9 COMD +s}"
137Ø PRINT"{CRSR RT}{CTRL 9}{COMD 8}{1Ø SPACEs}{CTRL 1}
     {COMD +}{CTRL 3}{3 SPACEs}{CTRL 1}{COMD +}{CTRL 5}
     {1Ø SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL
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Listing continued.

```
      1}{COMD +}{COMD 7}{8 SPACEs}"
138Ø PRINT"{CRSR RT}{CTRL 9}{COMD 8}{1Ø SPACEs}{CTRL 1}
     {COMD +}{CTRL 3}{3 SPACEs}{CTRL 1}{COMD +}{CTRL 5}
     {1Ø SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{COMD
      7}{9 SPACEs}"
139Ø PRINT"{CRSR RT}{CTRL 9}{COMD 8}{1Ø SPACEs}{CTRL 1}
     {COMD +}{CTRL 3}{3 SPACEs}{CTRL 1}{COMD +}{CTRL 5}
     {1Ø SPACEs}{CTRL 1}{COMD +}{CTRL 3}{3 SPACEs}{COMD
      7}{9 SPACEs}"
14ØØ PRINT"{CRSR RT}{CTRL 9}{COMD 8}{11 SPACEs}{CTRL 3}
     {3 SPACEs}{CTRL 1}{COMD +}{CTRL 5}{1Ø SPACEs}{CTRL
      1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL 1}{COMD +}{COMD
      7}{8 SPACEs}"
141Ø PRINT"{CRSR RT}{CTRL 9}{COMD 8}{11 SPACEs}{CTRL 3}
     {3 SPACEs}{CTRL 1}{COMD +}{CTRL 5}{1Ø SPACEs}{CTRL
      1}{COMD +}{CTRL 3}{3 SPACEs}{CTRL 1}{COMD +}{COMD
      7}{8 SPACEs}{HOME}"
142Ø PRINT"{HOME}{11 CRSR DNs}{CRSR RT}{CTRL 2}{CTRL 9}
     LIBRARY";TAB(19)"LIVING RM";TAB(34)"DEN"
143Ø PRINT"{11 CRSR DNs}{CRSR RT}{CTRL 2}{CTRL 9}KITCHE
     N";TAB(16)"LOUNGE";TAB(31)"STUDY{HOME}"
144Ø CL=54272:POKECL+15Ø7,2:POKECL+1526,2:POKECL+15Ø2,2
145Ø POKECL+1788,2:POKECL+1966,2:POKECL+1861,2:POKE1665
     ,2Ø9:POKE17Ø5,218
146Ø TQ1=1665:TP2=17Ø5
147Ø PRINTCHR$(142):POKE53265,PEEK(53265)OR16
148Ø GOSUB149Ø:GOSUB154Ø:GOSUB233Ø:GOTO2Ø8Ø
149Ø PRINT"{HOME}{COMD 8}";TAB(1Ø);D1$
15ØØ IFD=1THENRETURN
151Ø PRINTTAB(25)"{CRSR UP}";D2$
152Ø FORT=1TO15ØØ:NEXT
153Ø RETURN
154Ø IFPL=2THEN158Ø
155Ø PRINT"{HOME}{COMD 8}";TAB(1Ø);D1$
156Ø PRINTTAB(25)"{CRSR UP}{CTRL 1}{CTRL 9}{6 SPACEs}{C
     OMD 8}"
157Ø RETURN
158Ø PRINT"{HOME}";TAB(1Ø)"{CTRL 1}{CTRL 9}{6 SPACEs}{C
     OMD 8}"
159Ø PRINTTAB(25)"{CRSR UP}{COMD 8}";D2$
16ØØ RETURN
161Ø GOSUB2Ø1Ø:IFPL=1THENX=8:IFPL=1THENY=1
162Ø IFPL=2THENX=28:IFPL=2THENY=21
163Ø PRINT"{HOME}{COMD 8}";TAB(X)"{2 CRSR DNs}1.MRS LAN
     E"
164Ø PRINTTAB(X)"2.STEPSON"
165Ø PRINTTAB(Y)"PERSON:3.BUTLER"
166Ø PRINTTAB(X)"4.MAID"
167Ø PRINTTAB(X)"5.MISTRESS"
168Ø Q=5:GOSUB256Ø:REM GUESS STEPPER
169Ø GOSUB2Ø1Ø:REM BLANKS PLAYER SCRN
17ØØ GP=GS
171Ø PRINT"{HOME}";TAB(X)"{2 CRSR DNs}1.LIBRARY"
172Ø PRINTTAB(X)"2.LIVING RM"
173Ø PRINTTAB(X)"3.DEN"
174Ø PRINTTAB(Y)"ROOM:{2 SPACEs}4.KITCHEN"
175Ø PRINTTAB(X)"5.LOUNGE"
176Ø PRINTTAB(X)"6.STUDY"
177Ø Q=6:GOSUB256Ø
178Ø GOSUB2Ø1Ø
179Ø GR=GS
18ØØ PRINT"{HOME}";TAB(X)"{2 CRSR DNs}1.HAMMER"
181Ø PRINTTAB(X)"2.GUN"
182Ø PRINTTAB(Y)"WEAPON:3.CHAIN"
183Ø PRINTTAB(X)"4.KNIFE"
184Ø PRINTTAB(X)"5.POISON"
185Ø Q=5:GOSUB256Ø
186Ø GOSUB2Ø1Ø
187Ø GW=GS
188Ø PRINT"{HOME}";TAB(Y)"{2 CRSR DNs}PERSON:";P$(GP)
189Ø PRINTTAB(Y)"{CRSR DN}{2 CRSR RTs}ROOM:";R$(GR)
19ØØ PRINTTAB(Y)"{CRSR DN}WEAPON:";W$(GW)
191Ø GOSUB261Ø:FORT=1TO2ØØØ:NEXT
192Ø IFPL=1THENCO=7
193Ø IFPL=2THENCO=27
194Ø CB=Ø
195Ø IFP=GPTHENCB=CB+1
196Ø IFR=GRTHENCB=CB+1
197Ø IFW=GWTHENCB=CB+1
198Ø GOSUB299Ø:FORT=1TO13ØØ:NEXT:GOSUB3Ø3Ø
199Ø GOSUB226Ø:RETURN
2ØØØ PRINT"{HOME}";TAB(CO)"{2 CRSR DNs} "
2Ø1Ø PRINT"{HOME}{CRSR DN}"
2Ø2Ø IFPL=2THENB=21
2Ø3Ø IFPL=1THENB=1
2Ø4Ø FORI=1TO6
2Ø5Ø PRINTTAB(B)"{18 SPACEs}"
2Ø6Ø NEXT
2Ø7Ø RETURN
2Ø8Ø SP=15
2Ø9Ø IFSP=23THENSP=15
21ØØ PRINT"{HOME}{9 CRSR DNs}{15 CRSR RTs}{1Ø SPACEs}"
211Ø IFXV=1THEN213Ø
212Ø PRINT"{CTRL 1}"
213Ø PRINT"{HOME}";TAB(SP)"{9 CRSR DNs} {UP ARROW} "
214Ø PRINTTAB(23)"{CRSR UP} "
215Ø SP=SP+1
216Ø IFPEEK(197)=1THENPRINT"{CTRL 2}":GOTO129Ø
217Ø IFPL=1THENJP=5632Ø
```

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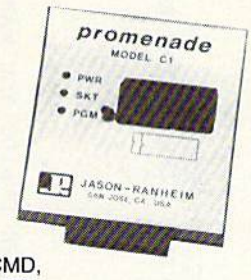

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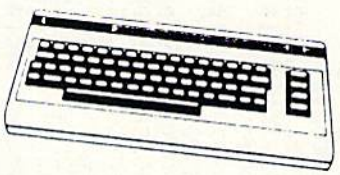

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Listing continued.

```
218Ø IFPL=2THENJP=56321
219Ø IFJP=5632ØTHENJØ=111
22ØØ IFJP=56321THENJØ=239
221Ø IFPEEK(JP)<>JØTHEN2Ø9Ø
222Ø IFSP=23THEN217Ø
223Ø PRINT"{HOME}";TAB(SP)"{CTRL 2}{9 CRSR DNs}{UP ARRO
     W} "
224Ø SP=SP-15
225Ø GOTO29Ø
226Ø IFPL=2THEN229Ø
227Ø RJ=INT(RND(Ø)*37)+1665
228Ø GOTO231Ø
229Ø RK=INT(RND(Ø)*37)+17Ø4
23ØØ GOTO232Ø
231Ø POKERJ,2Ø9:POKETQ1,16Ø:TQ1=RJ:GOTO233Ø
232Ø POKERK,218:POKETP2,16Ø:TP2=RK:GOTO233Ø
233Ø POKE54296,15:POKE54277,17:POKE54278,129
234Ø POKE54276,17:POKE54273,179:POKE54272,6
235Ø FORT=1TO1ØØ:NEXT:POKE54276,16:FORT=1TO1ØØ:NEXT:POK
     E54276,Ø:RETURN
236Ø NU=INT(RND(Ø)*5)+1
237Ø FORI=1TONU
238Ø TR=INT(RND(1)*518)+5574Ø
239Ø IFTR>562ØØORTR<5578ØTHEN238Ø
24ØØ IFTR>55936ANDTR<56Ø16THEN238Ø
241Ø IFPEEK(TR-CL)=2Ø9THENGOTO246Ø
242Ø IFPEEK(TR-CL)=218THENGOTO249Ø
243Ø IFPEEK(TR-CL)=116ORPEEK(TR-CL)=1Ø6ORPEEK(TR-CL)=1Ø
     ØTHEN238Ø
244Ø POKETR,Ø:POKETR-CL,1Ø2
245Ø GOSUB252Ø:NEXT:RETURN
246Ø POKETR,Ø:POKETR-CL,16Ø
247Ø GOSUB252Ø
248Ø POKE1665,2Ø9:TQ1=1665:NEXTI:RETURN
249Ø POKETR,Ø:POKETR-CL,16Ø
25ØØ GOSUB252Ø
251Ø POKE17Ø5,218:TP2=17Ø5:NEXTI:RETURN
252Ø POKE54296,15:POKE54277,95:POKE54278,197
253Ø POKE54276,33:POKE54273,6:POKES,16Ø
254Ø FORT=1TO1ØØ:NEXT:POKE54276,32:FORT=1TO25Ø:NEXT
255Ø RETURN
256Ø PRINT"{HOME}";TAB(15)"{9 CRSR DNs}{8 SPACEs}":GS=1
257Ø PRINTTAB(15+GS);"{CTRL 2}{CRSR UP}{UP ARROW}{CRSR
     LF}";:FORT=1TO1ØØ:NEXT
258Ø J=15-(PEEK(JP)AND15):GS=GS+((JAND8)=8)*(GS<Q)-((JA
     ND4)=4)*(GS>1)
259Ø IF(PEEK(JP)AND16)=ØTHENFORT=1TO3ØØ:NEXT:RETURN
26ØØ PRINT"{2 SPACEs}":GOTO257Ø
261Ø IFR=1THENWS=15Ø7
262Ø IFR=2THENWS=1526
263Ø IFR=3THENWS=15Ø2
264Ø IFR=4THENWS=1788
265Ø IFR=5THENWS=1966
266Ø IFR=6THENWS=1861
267Ø IFP=GPANDR=GRANDW=GWTHENWN=1
268Ø IFWN=1ANDPO=WSTHENWN=Ø:GOTO27ØØ
269Ø RETURN
27ØØ FORT=1TO1ØØØ:NEXT:IFPL=1THENWR$=D1$
271Ø IFPL=2THENWR$=D2$
272Ø PRINT"{SHFT CLR}":POKE53281,14:POKE5328Ø,14
273Ø PRINTTAB(9)"{3 CRSR DNs}{CTRL 1}CONGRATULATIONS ";
     WR$
274Ø PRINTTAB(6)" YOU HAVE SOLVED THE MYSTERY."
275Ø PRINT:PRINT:PRINTTAB(13)"TIME TO SOLVE:"
276Ø PRINT:PRINTTAB(15);MID$(TI$,3,2);" MINUTES"
277Ø PRINT:PRINTTAB(15);RIGHT$(TI$,2);" SECONDS"
278Ø BE=54272:FORCL=BETOBE+24:POKECL,Ø:NEXT
279Ø POKEBE+5,85:POKEBE+6,85:POKEBE+12,85:POKEBE+13,85
28ØØ POKEBE+24,15
281Ø POKEBE+4,33:POKEBE+11,17
282Ø FORX=1TO6:READH1,L1,H2,L2:POKEBE+1,H1:POKEBE,L1:PO
     KEBE+8,H2:POKEBE+7,L2
283Ø IFH1=5ØTHENFORT=1TO2ØØ:NEXT
284Ø FORT=1TO1ØØ:NEXT
285Ø DATA25,3Ø,18,2Ø9,33,135,25,3Ø,42,62,31,165,5Ø,6Ø,3
     7,162,42,62,31,165,5Ø,6Ø
286Ø DATA37,162
287Ø NEXTX
288Ø BE=54272:FORCL=BETOBE+24:POKECL,Ø:NEXT
289Ø PRINT:PRINT"{2 CRSR RTs}WOULD YOU LIKE TO TRY AGAI
     N-Y/N"
29ØØ GETAG$:IFAG$=""THEN29ØØ
291Ø IFAG$="Y"THENRUN
292Ø IFAG$="N"THENEND
293Ø GOTO29ØØ
294Ø PRINT"{HOME}{2 CRSR RTs}{16 CRSR DNs}DO YOU WANT S
     TEP GEN. VISIBLE (Y/N)"
295Ø GETV$:IFV$=""THEN295Ø
296Ø IFV$="Y"THENXV=1:RETURN
297Ø IFV$="N"THENXV=Ø:RETURN
298Ø GOTO295Ø
299Ø PRINT"{HOME}";TAB(Y)"{2 CRSR DNs}PERSON:{8 SPACEs}
     "
3ØØØ PRINTTAB(Y)"{CRSR DN}{2 CRSR RTs}ROOM:{11 SPACEs}"
3Ø1Ø PRINTTAB(Y)"{CRSR DN}WEAPON:{11 SPACEs}"
3Ø2Ø RETURN
3Ø3Ø PRINT"{HOME}";TAB(CO)"{4 CRSR DNs}{3 CRSR RTs}";CB
3Ø4Ø RETURN
```

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Listing 1. Songcode Loader program.

```
1 REM M.J. CLIFFORD
2 REM 2323 W. BANCROFT ST
3 REM TOLEDO OH 43607
10 REM SONGCODE.LOADER
15 PRINT"{SHFT CLR}{7 CRSR DNs}{11 CRSR RTs}{CTRL 9} ON
   E MOMENT PLEASE "
20 AD=12*4096
30 FORL=1TO48
40 FORX=0TO15:READB:C=C+B:POKEAD+X,B:NEXT
50 READK:IFC<>KTHENPRINT"ERROR IN DATA IN LINE";1000+L:
   END
60 C=0:AD=AD+16:NEXTL
80 PRINT"{2 CRSR DNs} SONGCODE IS NOW LOADED{2 CRSR DNs
   }"
90 PRINT"IT WILL BE SAVED ALONG WITH YOUR FIRST{2 SPACE
   s}SONG, IF YOU ENTER ONE NOW{CRSR DN}"
95 PRINT"OR YOU MAY SAVE IT NOW FOR FAST LOADING WHEN Y
   OU USE {CTRL 9}SONG EDITOR{CTRL 0}"
100 INPUT"{CRSR DN}SAVE IT NOW (Y/N) ";Q$:IFQ$="N"THENE
    ND
105 IFQ$<>"Y"THEN 100
110 PRINT"SAVING M.L. PROGRAM{CRSR DN}"
200 F$="SONGCODE"
210 POKE187,PEEK(71):POKE188,PEEK(72)
220 FA=PEEK(187)+256*PEEK(188)
230 POKE183,PEEK(FA)
240 POKE187,PEEK(FA+1):POKE188,PEEK(FA+2)
250 POKE251,0:POKE252,192
260 POKE186,8:POKE185,1
270 POKE780,251:POKE781,0:POKE782,195
280 SYS 65496
290 PRINT"MACHINE LANGUAGE IS SAVED AS "F$
300 PRINT"{CRSR DN}WHEN YOU RUN {CTRL 9}SONG EDITOR{CTR
    L 0} IT WILL BE{5 SPACEs}LOADED AUTOMATICALLY"
1000 REM ** SONG CODE DATA **
1001 DATA 169,4,141,71,194,141,72,194,169,0,141,4,212,1
     41,11,212,1876
1002 DATA 141,18,212,141,24,193,141,143,193,141,6,194,1
     73,252,194,141,2307
1003 DATA 21,212,173,253,194,141,22,212,173,254,194,141
     ,23,212,169,0,2394
1004 DATA 170,157,58,194,232,224,6,208,248,169,7,141,70
     ,194,120,173,2371
1005 DATA 20,3,141,192,192,173,21,3,141,193,192,169,93,
     141,20,3,1697
1006 DATA 169,192,141,21,3,88,173,255,194,141,24,212,96
     ,206,71,194,2180
1007 DATA 240,3,76,191,192,173,61,194,208,9,173,64,194,
     141,4,212,2135
1008 DATA 32,212,192,173,62,194,208,9,173,65,194,141,11
     ,212,32,75,1985
1009 DATA 193,173,63,194,208,9,173,66,194,141,18,212,32
     ,194,193,206,2269
1010 DATA 61,194,206,62,194,206,63,194,173,72,194,141,7
     1,194,173,70,2268
1011 DATA 194,208,28,120,173,192,192,141,20,3,173,193,1
     92,141,21,3,1994
1012 DATA 88,169,0,141,4,212,141,11,212,141,18,212,141,
     24,212,76,1802
1013 DATA 49,234,169,0,141,24,212,141,70,194,141,4,212,
     141,11,212,1955
1014 DATA 141,18,212,96,172,58,194,185,128,195,141,61,1
     94,190,0,195,2180
1015 DATA 224,207,176,22,189,161,194,188,74,194,141,0,2
     12,140,1,212,2335
1016 DATA 173,67,194,141,4,212,238,58,194,96,224,239,14
     4,27,138,41,2190
1017 DATA 15,205,24,193,240,9,238,24,193,169,0,141,58,1
     94,96,173,1972
1018 DATA 70,194,41,6,141,70,194,96,2,138,41,15,141,3,2
     12,200,1564
1019 DATA 185,0,195,141,5,212,185,128,195,141,6,212,200
     ,185,0,195,2185
1020 DATA 141,2,212,185,128,195,41,254,141,64,194,9,1,1
     41,67,194,1969
1021 DATA 238,58,194,238,58,194,238,58,194,208,137,172,
     59,194,185,128,2553
1022 DATA 196,141,62,194,190,0,196,224,207,176,22,189,1
     61,194,188,74,2414
1023 DATA 194,141,7,212,140,8,212,173,68,194,141,11,212
     ,238,59,194,2204
1024 DATA 96,224,239,144,27,138,41,15,205,143,193,240,9
     ,238,143,193,2288
1025 DATA 169,0,141,59,194,96,173,70,194,41,5,141,70,19
     4,96,2,1645
1026 DATA 138,41,15,141,10,212,200,185,0,196,141,12,212
     ,185,128,196,2012
1027 DATA 141,13,212,200,185,0,196,141,9,212,185,128,19
     6,41,254,141,2254
1028 DATA 65,194,9,1,141,68,194,238,59,194,238,59,194,2
     38,59,194,2145
1029 DATA 208,137,172,60,194,185,128,197,141,63,194,190
     ,0,197,224,207,2497
1030 DATA 176,22,189,161,194,188,74,194,141,14,212,140,
     15,212,173,69,2174
1031 DATA 194,141,18,212,238,60,194,96,224,239,144,27,1
     38,41,15,205,2186
1032 DATA 6,194,240,9,238,6,194,169,0,141,60,194,96,173
     ,70,194,1984
```

SERENADE

(from p. 83)

More

Listing 1 continued.

```
1033 DATA 41,3,141,70,194,96,2,138,41,15,141,17,212,200
     ,185,0,1496
1034 DATA 197,141,19,212,185,128,197,141,20,212,200,185
     ,0,197,141,16,2191
1035 DATA 212,185,128,197,41,254,141,66,194,9,1,141,69,
     194,238,60,2130
1036 DATA 194,238,60,194,238,60,194,208,137,96,74,79,61
     ,11,11,11,1866
1037 DATA 32,32,32,33,33,33,0,1,1,255,1,1,2,2,2,2,462
1038 DATA 2,2,2,3,3,3,3,3,4,4,4,4,5,5,5,6,58
1039 DATA 6,6,7,7,8,8,9,9,10,10,11,12,12,13,14,15,157
1040 DATA 16,17,18,19,20,21,22,24,25,27,28,30,32,34,36,
     38,407
1041 DATA 40,43,45,48,51,54,57,61,64,68,72,76,81,86,91,
     96,1033
1042 DATA 102,108,115,122,129,137,145,153,163,172,183,1
     93,205,217,230,244,2618
1043 DATA 0,205,233,6,37,69,104,140,179,220,8,54,103,15
     5,210,12,1735
1044 DATA 73,139,208,25,103,185,16,108,206,53,163,23,14
     7,21,159,50,1679
1045 DATA 205,114,32,216,156,107,70,47,37,42,63,100,154
     ,227,63,177,1810
1046 DATA 56,214,141,94,75,85,126,200,52,198,127,97,111
     ,172,126,188,2062
1047 DATA 149,169,252,161,105,140,254,194,223,88,52,120
     ,43,83,247,31,2311
1048 DATA 210,25,252,133,189,176,103,0,0,0,0,0,0,0,0,15
     ,1103
```

Listing 2. Song Editor program.

```
1 REM SONG EDITOR
2 REM M.J.CLIFFORD
3 REM 2323 W. BANCROFT
4 REM TOLEDO, OH 43607
6 PRINT"{SHFT CLR}{4 CRSR DNs}{CTRL 9}LOADING MACHINE L
  ANGUAGE"
10 IFPEEK(49152)<>169THENLOAD"SONGCODE",8,1
20 PRINT"{SHFT CLR}{5 CRSR DNs}{14 SPACEs}{CTRL 9} SONG
    EDITOR {CTRL 0}{2 CRSR DNs}"
40 FORX=0TO6:READNV(X):NEXT
50 NA=12*4096+256*3:PA=NA-4:DA=NA+128
55 INPUT"{2 CRSR DNs}NEW SONG OR EDIT (N/E)";Q$:IFQ$<>"
   N"THEN800
60 PRINT"{CRSR DN}{CTRL 9}CLEARING SONG MEMORY"
65 FORX=0TO3:POKEPA+X,0:NEXT
70 FORY=0TO2:A=NA+256*Y
75 FORX=0TO255:POKEA+X,0:NEXT:NEXT
80 POKEPA+3,15
90 GOSUB1600
100 FORV=0TO2:N=1:GOSUB500:GOSUB330:NEXTV:GOTO800
329 REM ** NOTE VALUES **
330 GOSUB1700
335 TT=0
340 FOR N=3TO126:PRINT"{HOME}{20 CRSR DNs}NOTE #";N-2
345 NT=PEEK(NA+256*V+N):D=PEEK(DA+256*V+N):IFNT=0THEN N
    T=1
350 IFNT>239THENN$="RE":OC=NT-240:GOTO410
355 IFNT>207THENN$="CV":OC=NT-208:GOTO410
360 IFNT=86THENN$="R":OC=0:GOTO410
365 OC=INT(NT/12):T=NT-OC*12:OC=OC+1:IFT=0THENT=12:OC=O
    C-1
370 IFT=1ANDNV(1)=13THENN$="B":OC=OC-1:GOTO410
372 IFT=10ANDNV(6)=9THENN$="G#":GOTO410
375 IFT=2ANDNV(1)=14THENN$="B":OC=OC-1:GOTO410
380 Y=2
385 IFT=NV(Y)THENN$=CHR$(65+Y):GOTO410
390 IFT<NV(Y)THENN$=CHR$(64+Y)+"#":GOTO410
395 IFY>1ANDY<6THENY=Y+1:GOTO385
400 IFY=6THENY=0:GOTO385
405 IFY=0THENY=1:GOTO385
410 PRINT"{22 CRSR RTs}{15 SPACEs}{CRSR UP}"
415 PRINT"{22 CRSR RTs}"N$","MID$(STR$(OC),2)","MID$(ST
    R$(D),2)"{CRSR UP}"
420 INPUT"NOTE,OCTAVE,DURATION";N$,OC,D
425 IFN$="RE"THENNT=240+OC:GOTO455
430 IFN$="CV"THENN=N+1:GOSUB500:GOSUB1700:GOTO465
435 IFN$="R"THENNT=86:GOTO455
440 IFOC<1OROC>7THENPRINT"{2 CRSR UPs}":GOTO410
445 T=ASC(N$)-65:NT=NV(T)+12*(OC-1):IFNT<0THENNT=0
450 IFRIGHT$(N$,1)="#"THENNT=NT+1
455 POKENA+256*V+N,NT:POKEDA+256*V+N,D:TT=TT+D
460 IFNT>239THENN=127
465 NEXTN:POKENA+256*V+127,240:POKEDA+256*V+127,1
470 PRINT"{SHFT CLR}{5 CRSR DNs}TOTAL DURATION OF THIS
    VOICE":PRINT"{CRSR DN}IS";TT;"16TH NOTES"
475 PRINT"{3 CRSR DNs}PRESS {CTRL 9}SPACE{CTRL 0} TO CO
    NTINUE"
480 PRINT"{CRSR DN}PRESS {CTRL 9}R{CTRL 0} TO REENTER N
    OTES FOR{13 SPACEs}THIS VOICE"
485 GETA$:IFA$=""THEN485
490 IFA$="R"THEN330
495 RETURN
499 REM ** SOUND ENVELOPE **
500 PRINT"{SHFT CLR}{5 CRSR DNs}FOR VOICE #";V+1;":{CRS
    R DN}"
510 Z=PEEK(NA+V*256+N):AT=INT(Z/16):DE=Z-16*AT
520 PRINT"{14 CRSR RTs}"AT"{CRSR UP}"
530 INPUT"ATTACK (0-15)";AT:IFAT<0ORAT>15THEN520
```

More →

Listing 2 continued.

```
54Ø PRINT"{CRSR DN}{13 CRSR RTs}"DE"{2 CRSR UPs}"
55Ø INPUT"{CRSR DN}DECAY (Ø-15)";DE:IFDE<ØORDE>15THEN54
    Ø
56Ø POKE NA+V*256+N,16*AT+DE
57Ø Z=PEEK(DA+N+V*256):SU=INT(Z/16):RE=Z-16*SU
59Ø PRINT"{CRSR DN}{15 CRSR RTs}"SU"{2 CRSR UPs}"
6ØØ INPUT"{CRSR DN}SUSTAIN (Ø-15)";SU:IFSU<ØORSU>15THEN
    59Ø
61Ø PRINT"{CRSR DN}{15 CRSR RTs}"RE"{2 CRSR UPs}"
62Ø INPUT"{CRSR DN}RELEASE (Ø-15)";RE:IFRE<ØORRE>15THEN
    61Ø
63Ø POKEDA+N+V*256,16*SU+RE:N=N+1
64Ø PV=PEEK(DA+N+V*256):R$="N":IF(PVAND4)THENR$="Y"
65Ø S$="N":IF(PVAND2)THENS$="Y"
66Ø PV=INT(PV/16):WV=-(PV=2)-2*(PV=4)-3*(PV=8)+1
67Ø PRINT"{CRSR DN}{11 CRSR RTs}"WV"{2 CRSR UPs}"
68Ø INPUT"{CRSR DN}WAVE (1-4)";WV:IFWV<1ORWV>4THEN67Ø
69Ø IFWV=1THENPRINT"{CRSR DN} RING MODULATE WITH VOICE"
    ;V-3*(V=Ø);
7ØØ IFWV=1THENPRINT"(Y/N){2 CRSR RTs}"R$"{3 CRSR LFs}";
    :INPUTR$
71Ø PRINT"{CRSR DN} SYNCHRONIZE WITH VOICE";V-3*(V=Ø);
72Ø PRINT"(Y/N){2 CRSR RTs}"S$"{3 CRSR LFs}";:INPUTS$
73Ø PV=2{UP ARROW}(WV-1)*16-4*(R$="Y")-2*(S$="Y"):POKED
    A+N+V*256,PV
74Ø P1=PEEK(NA+256*V+N-2)AND15:P2=PEEK(NA+N+V*256):PW=2
    56*P1+P2
75Ø IFWV<>3THEN79Ø
76Ø PRINT"{21 CRSR RTs}"PW"{CRSR UP}"
77Ø INPUT"PULSE WIDTH (Ø-4Ø95)";PW:IFPW<ØORPW>4Ø95THEN3
    96
78Ø P1=INT(PW/256):P2=PW-256*P1
79Ø POKE(NA+256*V+N),P2:POKE(NA+256*V+N-2),P1+2Ø8:RETUR
    N
799 :
8ØØ PRINT"{SHFT CLR}{3 CRSR DNs}{2 CRSR RTs}DO YOU WISH
     TO:{CRSR DN}"
81Ø PRINT"{3 SPACEs}1> CHANGE WAVE,ETC":PRINT"{3 SPACEs
    }2> CHANGE NOTE VALUES"
815 PRINT"{3 SPACEs}3> CHANGE/SET FILTER"
82Ø PRINT"{3 SPACEs}4> PLAY THE SONG":PRINT"{3 SPACEs}5
    > SAVE SONG/EXIT{CRSR DN}"
83Ø INPUT"YOUR CHOICE";C
84Ø IFC<1ORC>5THEN8ØØ
85Ø ONC GOTO 87Ø,88Ø,95Ø,9ØØ,19ØØ
87Ø FORV=ØTO2:N=1:GOSUB5ØØ:NEXTV:GOTO8ØØ
88Ø INPUT"{2 CRSR DNs}FOR WHICH VOICE";V:IFV<1ORV>3THEN
    88Ø
885 GOSUB18ØØ
89Ø V=V-1:GOSUB33Ø:GOTO8ØØ
9ØØ INPUT"{CRSR DN}AT WHAT TEMPO";TP
9Ø5 PRINT"{2 CRSR DNs}TYPE {CTRL 9} Q {CTRL Ø} TO INTER
    RUPT SONG{2 CRSR DNs}"
91Ø POKE78Ø,TP:SYS49154
92Ø IFPEEK(788)=49THEN8ØØ
93Ø GETA$:IFA$<>"Q"THEN92Ø
94Ø SYS 49344 :REM STOP SONG
945 GOTO8ØØ
949 REM**FILTRATION**
95Ø PRINT"{SHFT CLR}{4 CRSR DNs}FILTRATION{2 CRSR DNs}"
955 Z=PEEK(PA)+8*PEEK(PA+1)
96Ø PRINT"{16 CRSR RTs}"Z"{CRSR UP}"
965 INPUT"CUTOFF (Ø-2Ø47)";CF:IFCF<ØORCF>2Ø47THEN96Ø
97Ø CH=INT(CF/8):POKEPA,CF-8*CH:POKEPA+1,CH
975 Z=PEEK(PA+2):FL=Ø
98Ø PRINT"{17 CRSR RTs}"INT(Z/16)"{CRSR UP}"
985 INPUT"RESONANCE (Ø-15)";RS:IFRS<ØORRS>15THEN98Ø
99Ø FORV=ØTO2:PRINT"{17 CRSR RTs}"CHR$(78+11*((ZAND(2{U
    P ARROW}V))/(2{UP ARROW}V)))"{CRSR UP}"
995 PRINT"FILTER VOICE";V+1;:INPUTQ$:IFQ$="Y"THENFL=FL+
    2{UP ARROW}V
1ØØØ NEXT:FL=FL+16*RS:POKEPA+2,FL
1Ø1Ø Z=PEEK(PA+3):M=Ø
1Ø2Ø PRINT"{1Ø CRSR RTs}"CHR$(78+11*((ZAND16)/16))"{CRS
    R UP}"
1Ø3Ø INPUT"LOW-PASS";Q$:IFQ$="Y"THENM=16
1Ø4Ø PRINT"{1Ø CRSR RTs}"CHR$(78+11*((ZAND32)/32))"{CRS
    R UP}"
1Ø5Ø INPUT"BANDPASS";Q$:IFQ$="Y"THENM=M+32
1Ø6Ø PRINT"{11 CRSR RTs}"CHR$(78+11*((ZAND64)/64))"{CRS
    R UP}"
1Ø7Ø INPUT"HIGH-PASS";Q$:IFQ$="Y"THENM=M+64
1Ø8Ø PRINT"{8 CRSR RTs}"CHR$(78+11*((ZAND128)/128))"{CR
    SR UP}"
1Ø9Ø INPUT"V3 OFF";Q$:IFQ$="Y"THENM=M+128
11ØØ PRINT"{14 CRSR RTs}"ZAND15"{CRSR UP}"
111Ø INPUT"VOLUME (1-15)";VL:IFVL<1ORVL>15THEN11ØØ
112Ø POKEPA+3,M+VL
113Ø GOTO8ØØ
1599 REM ** SET KEY **
16ØØ RESTORE:FORX=ØTO6:READNV(X):NEXT
161Ø PRINT"{SHFT CLR}{3 CRSR DNs}SET KEY SIGNATURE FOR
    SONG"
162Ø PRINT"ENTER THE NOTES WHICH ARE #":PRINT" FOR EXAM
    PLE: ACE (Ø IF NONE) {2 CRSR DNs}"
163Ø INPUTK$
1635 IFK$="Ø"THEN166Ø
164Ø FORZ=1TOLEN(K$):Y=ASC(MID$(K$,Z,1))-65:NV(Y)=NV(Y)
    +1:NEXTZ
```

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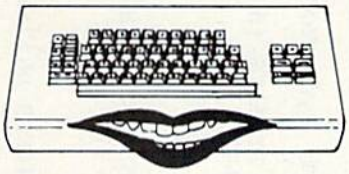

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Listing 2 continued.

```
166Ø PRINT"{2 CRSR DNs}ENTER NOTES WHICH ARE FLAT{CRSR
     DN}"
167Ø INPUTK$:IFK$="Ø"THEN RETURN
168Ø FORZ=1TOLEN(K$):Y=ASC(MID$(K$,Z,1))-65:NV(Y)=NV(Y)
     -1:NEXTZ
169Ø RETURN
1695 DATA 11,13,2,4,6,7,9
17ØØ PRINT"{SHFT CLR}NOTE VALUES:{CRSR DN}"
171Ø PRINT"{16 SPACEs}{SHFT O}{1Ø SPACEs}{COMD G}
1715 PRINT"{2 SPACEs}G{COMD T}{5 SHFT Cs}F{6 SPACEs}{SH
     FT O}{2 SPACEs}= 1{4 SPACEs}{SHFT Q}{COMD G}. = 6
172Ø PRINT"5 E{COMD T}{5 SHFT Cs}D{5 SPACEs}{SHFT Q}{CO
     MD G}
173Ø PRINT"{COMD Z}{SHFT C}C{COMD T}{5 SHFT Cs}B{SHFT C
     }{COMD S}
1735 PRINT"{2 SPACEs}A{COMD T}{5 SHFT Cs}G {SHFT B}{4 S
     PACEs}{SHFT O}{1Ø SPACEs}{COMD G}
174Ø PRINT"{2 SPACEs}F{COMD T}{5 SHFT Cs}E 4{3 SPACEs}{
     SHFT Q}{COMD G}{2 SPACEs}= 2{4 SPACEs}{SHFT W}{COM
     D G}{2 SPACEs}= 8
1745 PRINT"{2 SPACEs}D{COMD T}{2 SPACEs}{SHFT C} C{2 SH
     FT Cs}{COMD X}
175Ø PRINT"{COMD A}{SHFT C}B{COMD T}{5 SHFT Cs}A{6 SPAC
     Es}{SHFT O}{1Ø SPACEs}{COMD G}
1755 PRINT"{SHFT B} G{COMD T}{5 SHFT Cs}F{5 SPACEs}{SHF
     T Q}{COMD G}. = 3{4 SPACEs}{SHFT W}{COMD G}. = 12
176Ø PRINT"3 E{COMD T}{5 SHFT Cs}D
1765 PRINT"{COMD Z}{SHFT C}C{COMD T}{5 SHFT Cs}B{SHFT C
     }{COMD S}{4 SPACEs}{COMD G}
177Ø PRINT"{2 SPACEs}A{COMD T}{5 SHFT Cs}G 2{3 SPACEs}{
     SHFT Q}{COMD G}{2 SPACEs}= 4{4 SPACEs}{SHFT W}{3 S
     PACEs}= 16
1775 PRINT"{CRSR DN}{3 SPACEs}REST: R,Ø,DURATION"
178Ø PRINT"CNG ENV: CV,Ø,1"
179Ø PRINT"{3 SPACEs}END : RE,#OF REPEATS (Ø-15),TIME O
     F{11 SPACEs}REST BEFORE REPEAT"
1795 RETURN
18ØØ REM CHECK KEY SIGNATURE
181Ø RESTORE:SK$="":FK$=""
182Ø FORY=ØTO6:READX:IFNV(Y)>XTHENSK$=SK$+CHR$(65+Y)
183Ø IFNV(Y)<XTHENFK$=FK$+CHR$(65+Y)
184Ø NEXTY:IFSK$=""THENSK$="NONE"
185Ø IFFK$=""THENFK$="NONE"
186Ø PRINT"CURRENT KEY SIGNATURE:{CRSR DN}":PRINT"SHARP
     ED NOTES: "SK$
187Ø PRINT"FLATTED NOTES: ";FK$
188Ø PRINT"OK (Y/N){3 SPACEs}Y{3 CRSR LFs}";:INPUTQ$:IF
     Q$="Y"THENRETURN
189Ø GOTO16ØØ
19ØØ PRINT"{SHFT CLR}{5 CRSR DNs}DO YOU WISH TO SAVE TH
     IS SONG":INPUT"(Y/N)";Q$
191Ø IFQ$="N"THENEND
192Ø IFQ$<>"Y"THEN 19ØØ
2ØØØ REM *** SAVE SONGS ***
2ØØ5 F$=""
2Ø1Ø INPUT"{CRSR DN}NAME OF SONG";F$:IFF$=""THEN 2Ø1Ø
2Ø2Ø F$=F$+".SNG"
2Ø3Ø POKE187,PEEK(71):POKE188,PEEK(72)
2Ø4Ø FA=PEEK(187)+256*PEEK(188)
2Ø5Ø POKE183,PEEK(FA)
2Ø6Ø POKE187,PEEK(FA+1):POKE188,PEEK(FA+2)
2Ø7Ø POKE251,Ø:POKE252,192
2Ø8Ø POKE186,8:POKE185,1
2Ø9Ø POKE78Ø,251:POKE781,Ø:POKE782,198
21ØØ SYS65496
211Ø PRINT"DONE{CRSR DN}":END
```

Listing 3. Program that contains data for a song.

```
1Ø REM SONG DATA FOR START UP
2Ø PRINT"{SHFT CLR}{5 CRSR DNs}{11 CRSR RTs}{CTRL 9} ON
   E MOMENT PLEASE "
3Ø AD=49916
35 FORL=1TO47
4Ø FORX=ØTO15:READB:C=C+B:POKEAD+X,B:NEXT
5Ø READK:IFC<>KTHENPRINT"ERROR IN DATA IN LINE";1ØØØ+L:
   END
6Ø C=Ø:AD=AD+16:NEXTL
1ØØ PRINT"SONG DATA IS LOADED{CRSR DN}"
11Ø PRINT"NOW LOAD AND RUN {CTRL 9}SONG EDITOR"
1ØØØ REM *** SONG DATA ***
1ØØ1 DATA Ø,8Ø,192,15,2Ø8,66,127,57,56,57,54,86,57,56,5
     7,54,1222
1ØØ2 DATA 86,57,56,57,62,64,62,62,73,86,73,62,73,62,64,
     62,1Ø61
1ØØ3 DATA 62,73,86,73,62,73,71,86,71,73,71,69,86,57,56,
     57,1126
1ØØ4 DATA 54,86,57,56,57,54,86,57,56,57,62,64,62,62,73,
     86,1Ø29
1ØØ5 DATA 86,64,63,64,62,62,73,86,71,57,58,71,73,62,57,
     58,1Ø67
1ØØ6 DATA 71,58,71,71,55,54,52,71,55,56,54,56,57,57,54,
     52,944
1ØØ7 DATA 5Ø,57,57,62,64,62,73,64,71,57,73,73,62,64,62,
     73,1Ø24
1ØØ8 DATA 64,71,57,62,62,241,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,557
1ØØ9 DATA Ø,Ø,Ø,24Ø,Ø,165,16,2,2,4,4,4,2,2,4,4,449
1Ø1Ø DATA 4,2,2,4,4,4,4,4,4,4,2,2,4,4,4,4,56
```

More →

Listing 3 continued.

```
1Ø11 DATA 4,4,4,2,2,4,4,4,2,2,4,4,2,2,4,52
1Ø12 DATA 4,4,2,2,4,4,4,2,2,4,4,4,4,4,4,56
1Ø13 DATA 4,6,2,6,2,4,4,4,4,4,4,4,8,4,4,68
1Ø14 DATA 8,4,4,4,4,4,4,24,4,4,8,4,4,4,4,92
1Ø15 DATA 4,16,4,4,4,4,12,4,12,4,16,4,4,4,4,12,112
1Ø16 DATA 4,12,4,16,4,12,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,52
1Ø17 DATA Ø,Ø,Ø,1,2Ø8,9,127,54,53,54,5Ø,86,54,53,54,5Ø,
     853
1Ø18 DATA 86,86,5Ø,56,55,55,86,57,59,55,55,55,55,55,55,
     86,1ØØ6
1Ø19 DATA 55,57,55,86,53,54,54,86,54,53,54,5Ø,86,54,53,
     54,958
1Ø2Ø DATA 5Ø,86,86,5Ø,56,55,55,86,57,57,57,57,57,55,86,
     55,1ØØ5
1Ø21 DATA 55,55,55,54,86,55,54,55,55,59,45,43,86,43,86,
     43,929
1Ø22 DATA 86,5Ø,52,53,54,5Ø,53,54,54,45,43,42,86,42,86,
     42,892
1Ø23 DATA 86,42,42,42,4Ø,43,33,43,4Ø,49,33,49,4Ø,43,33,
     43,7Ø1
1Ø24 DATA 4Ø,47,43,86,43,42,42,241,Ø,Ø,Ø,Ø,Ø,Ø,Ø,584
1Ø25 DATA Ø,Ø,Ø,24Ø,Ø,Ø,64,2,2,4,4,2,2,4,4,332
1Ø26 DATA 4,4,8,8,4,4,4,2,2,4,4,4,4,4,4,68
1Ø27 DATA 4,4,4,4,4,4,4,4,2,2,4,4,4,2,2,4,56
1Ø28 DATA 4,4,4,8,8,4,4,4,4,6,2,6,2,8,4,4,76
1Ø29 DATA 8,4,4,8,12,4,4,4,4,4,4,4,4,4,4,8Ø
1Ø3Ø DATA 4,4,4,4,4,4,4,4,4,4,4,4,4,4,4,64
1Ø31 DATA 4,4,4,4,4,4,4,4,4,4,4,4,4,4,4,64
1Ø32 DATA 4,4,4,32,4,16,4,12,Ø,Ø,Ø,Ø,Ø,Ø,Ø,8Ø
1Ø33 DATA Ø,Ø,Ø,1,2Ø8,9,127,86,38,86,33,86,38,86,33,86,
     917
1Ø34 DATA 3Ø,29,28,86,33,86,28,86,33,86,28,86,33,86,28,
     86,872
1Ø35 DATA 33,86,26,86,33,86,38,86,33,86,38,86,33,86,3Ø,
     29,895
1Ø36 DATA 28,86,33,86,61,6Ø,61,59,59,45,28,33,4Ø,43,45,
     38,8Ø5
1Ø37 DATA 86,4Ø,86,33,86,28,86,33,86,4Ø,49,47,33,38,86,
     45,9Ø2
1Ø38 DATA 86,38,86,45,86,38,49,47,33,86,33,43,4Ø,43,33,
     43,829
1Ø39 DATA 4Ø,49,33,86,38,47,33,3Ø,26,241,Ø,Ø,Ø,Ø,Ø,Ø,62
     3
1Ø4Ø DATA Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø,Ø
1Ø41 DATA Ø,Ø,Ø,24Ø,Ø,Ø,64,4,4,4,4,4,4,4,4,34Ø
1Ø42 DATA 8,8,4,4,4,4,4,4,4,4,4,4,4,4,4,72
1Ø43 DATA 4,4,4,4,4,4,4,4,4,4,4,4,4,8,8,72
1Ø44 DATA 4,4,4,4,6,2,6,2,4,4,8,4,4,4,8,72
1Ø45 DATA 8,4,4,4,4,4,4,4,8,8,8,8,4,4,4,84
1Ø46 DATA 4,4,4,4,4,8,8,8,8,56,4,4,4,4,4,132
1Ø47 DATA 4,4,4,4,6,2,4,4,4,12,Ø,Ø,Ø,Ø,Ø,Ø,48
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The Mail RUN

Small but Great

I have read many computer magazines and, until I purchased *RUN*, had never seen a column like Magic. It gives us computer hobbyists a chance to read and share small but important items that normally would be too small for publication.

Liam Murray
Seattle, WA

Commodores Overseas

Within a day or two of your magazine getting onto the news racks "down-under," they're sold out. I consider *RUN* to be the best of dozens of magazines available for Commodore computerists.

As a journalist, and a skeptical one at that, I was impressed with your first two issues and wondered if you could keep up the quality and quantity of your articles. Well, you have.

Commodore 64s are selling in the thousands down here, so much so that Commodore has been overwhelmed with orders. The Victorian Government has recently signed a multimillion-dollar deal with Commodore for the supply of C-64s and peripherals for use in their state schools.

Thanks again for a magazine that maintains the balance between the serious programmer and the games fanatic.

David Hinley
Tasmania, Australia

As a reader from across "the pond," may I congratulate the *RUN* staff on producing such a fine magazine. It is far superior to any of the computer magazines that are produced over here.

From your April issue, which I did not manage to get hold of until the beginning of June, I found your article and program "Disk Editor 64" very useful in enabling me to recover two programs that I thought had been lost forever. The article, "C-64 Superkeys," also looks good, but I have yet to find the time to key it in.

Another thing that I found interesting was the prices of games and business programs in your country as compared to the prices of such programs in my country. In England, game programs are cheap, typically costing between £ 1.99 and £5.95 (approximately $2.65 and $8). Good business programs, on the other hand, cost £75 to £100 (approximately $100 to $135). I see that in the States game programs cost much more and business programs much less. Peripherals also seem to cost much less in the States than they do over here. I am planning to visit the States in October, so I reckon that as a result of buying your magazine, I will save quite a bit of money.

David Jones
Birmingham, England

Hams: Exchange Programs

I recently received an issue of *RUN* from a friend who had been in the States. I found it quite interesting and useful in helping me to better know and play with my C-64 and disk drive.

As a radio amateur, I am interested in getting in touch with other radio amateurs who own C-64s and would like to send and receive programs via radio.

Those of you who are interested in doing so, please contact me.

Carlos Gomez Lorez
Los Huancus 215
Lima 32, Peru
South America

Stationed Overseas?

I am stationed overseas in the city of Nuremburg, Germany, with the U.S. Army. Jim Strasma's answer to my question in April's Commodore Clinic was very helpful to me in bringing my C-64 overseas. I had thought my computer days were over when I was sent overseas, but not so. Without AFN (American Forces Network), the C-64 is our major source of entertainment.

I wanted to give some guidelines to other GIs. We have ten or more personnel in our company alone who have C-64s. There are a lot more out there. Each casern has some user groups. As for the voltage, use your American NTSC TV set, and get a 1000 watt 220/110 transformer. This way, you can plug in your TV and C-64 power supply. This works for our systems.

Now, you need only learn the German language so you can play the German adventure games. And keep your subscription to *RUN*. The APO (Army Post Office) will always get it to you (in one form or another) before it comes out on the Stars and Stripes newsstand.

SP5 Ron Moore
APO New York, NY

Particularly Interesting

I want to thank you for your excellent articles by Jim Grubbs on the user's port ("Gateway to the World," May 1984, June 1984). I also enjoyed "Morse Code Medley," by Tom Meixner, in your July 1984 issue.

I think *RUN* is the best magazine for the C-64. I hope to see more of Jim Grubbs' articles on the user's port.

Allen B. Fugelseth
Capitola, CA

Thanks for your comments. We'll be publishing more of Mr. Grubbs' interfacing articles in the near future.

Editors

A Timely Article

I was pleased with John Kula's article, "Custom Keyboard," in your July issue. This article helped me transform my Cardco Cardkey 1 numeric keypad from a paperweight into what I actually needed—a usable numeric keypad.

Kenneth P. Shaw
Brooklyn, NY

Commodore 16 Isn't the Answer

Commodore's announcement of their new Commodore 16 shows a near-sighted attitude. The world needs the Commodore 16 like it needs the 66-⅔ RPM LP. We don't need more cheap

computers, especially ones that run only system-specific software. Look at the Mattel Aquarius, Timex Sinclair 1000, Spectra-Video 318, TI 99/4 and so on.

What we do need are computers that do useful work, that are easier and faster to use, and that have good software development tools. Commodore should work on supporting its biggest base of support—its existing customers.

Why hasn't Commodore put out a reasonably priced parallel or IEEE disk drive for the C-64? The 1541 disk drive is an embarrassment; I certainly can't recommend it to anyone who asks about computers. It takes 35 seconds to store a hi-res graphics screen. The Apple II+ takes 3.5 seconds—10 times faster than the 1541! How many non-computer nuts do you know who are willing to wait three or four minutes for a program to load?

What about improving the C-64's Basic? It is extremely slow, has no monitor, graphics, sound nor DOS commands. I understand the Commodore 16 will have a version 3.5 Basic with some of these features. Fine, but why not make them available to C-64 owners? Owners of even early Apple IIs can run most of the current software (including machine language programs) because the manufacturer took pains to ensure compatibility. The result was an unusually long product life, loyal owners and an enormous amount of third-party software and hardware. Where is that kind of support from Commodore?

One useful piece of software I have yet to see for the C-64 is a program for printing out different sizes and styles of type on the hi-res screen and on dot matrix printers. Just the sort of thing for putting out newsletters and fliers. This is what the Macintosh is famous for, and there are half a dozen similar programs for the Apple II. There's not even *one* for the Commodore.

How about a music program that offers dynamic filter modulation, the sound that made the Moog famous ("wow," "yeow," "waw-waw" and so on)? It is possible on the C-64, but I have yet to see it implemented. Also, where is the long-promised organ keyboard?

Because there's so much that I like about the C-64, I am especially frustrated with its shortcomings. I know that better is possible, but hobbyists aren't going to achieve it alone. We need support from Commodore Business Machines—not in the form of new machines every year, but with steady improvement and expansion of their leading product, the Commodore 64.

Rick Seaman
Portland, OR

801 with 20 and 64

This has been bugging me since I received your July issue of *RUN*. In one of your Commodore Clinic columns, your columnist, in response to a question, said, "The new 801 and 1526 printers do not appear to work on the VIC."

Now, I'm not one to argue, but, the MPS-801 (of which I am a proud owner) *does* work with the VIC-20, and it works very well. It did, however, take me a long time to find this out.

About three months ago, I too was looking for a printer that would work with my VIC; Commodore had some good-looking, good-printing ones, but they were out of my price range...except for one, which was the 1525, but it did not look right. (To say this is reason enough to buy or not to buy is totally false, but something just turned me off when I looked at it.) Right next to it was an MPS-801 carton, on which there was a big sign that read "For the Commodore 64 Only." The MPS-801; well, what a nice name and how pretty she looked, and she was only $220 (the 1525 was $250). However, that great big tag, which claimed the machine was only for the C-64, kept drawing my attention.

At that point, I called on a K-Mart salesperson. I asked him, "Does the MPS-801 work with the VIC-20?"

He looked at me rather strangely and said, "See the tag? It says for the 64 only."

"Yes," I said, "I know, but the VIC and the 64 have the same port, and since they use the same ASCII...."

"All I know," he said, "is that Commodore says it will not work."

Off I went. In two weeks, I had finally saved enough money to buy the 1525, but, guess what? I could not find it anywhere. I asked the K-Mart salesperson what happened to the 1525 printer, to which he replied, "We replaced it."

"Replaced it? With what?" I asked.

Looking very pleased with himself, he said, "The MPS-801."

Replaced it! How could Commodore do something so dumb as to replace a C-64 and VIC-20 printer with one that only works with a C-64? But, never mind, my problem now was to find a 1525, and *fast*! I tried K-Marts all over Georgia; they did not sell them anymore, but they had plenty of the MPS-801s. Next, I tried Wilson's and World Hi-Fi, with no luck. Then I called Commodore and asked, "Do you have any 1525s left?"

Their answer: "Why, yes, but why don't you buy the 801?"

"Because," I said, "it does not work on the VIC-20." Without a pause, the Commodore representative replied, "Oh, yes it does work."

So, K-Mart says it doesn't work and Commodore says that it does. What now? I figured that Commodore knows more about it than K-Mart, so I proceeded to K-Mart to do some more investigating. I asked to see the MPS manual, which said the 801 works with "the VIC-20 or C-64." So, taking a big gamble, I laid the cash on them and walked out of K-Mart with a printer that was "nonreturnable."

I went immediately to Radio Shack for some paper (K-Mart did not have any), then straight home to install my new "maybe-it-works, maybe-it-doesn't" printer to my VIC-20. After ten minutes of reading the manual and plugging in plugs and connectors, I was ready to apply power to the VIC-20. After it warmed up, I was ready to apply power to the printer—cross your fingers.

Zoom...zoom...it came to life. There was no smoke. No explosion. Just the wonderful sound of the MPS-801 purring away. Wiping the sweat from my brow, I typed the following: "OPEN 4,4". The screen displayed READY. I typed in "CMD 4". A noise only a printer could make came out of the MPS. READY was typed, crisp and clean, on the white paper.

Well, it works, and I am happy, very happy, that I got the MPS-801 instead of the 1525. Besides being less expensive, it is also a better printer; it is faster and it does not have letter problems, as does the 1525 (ask Commodore about that). Its lettering is almost letter quality, and *she looks great.*

Kevin Dowd
Scott, GA

Commodore Clinic

By Jim Strasma

Commodore Clinic is a monthly column designed to help you, the RUN *reader, through any troubles or questions you have as you use your VIC-20 or C-64 computer. Send questions, along with an SASE, to:*

Jim Strasma
Commodore Clinic
1238 Richland Ave.
Lincoln, IL 62656

So this column can help as many people as possible, please try to limit your questions to topics of general interest, and limit each letter to one question. Including a full-sized (#10) prepaid self-addressed envelope will ensure a reply even if your letter does not appear in print. I do ask that you do not call, though, because my telephone does not type, and only typed questions can help others through this column.

Software

Q: Is there a version of VisiCalc for the 64?

Paul Gunzenhauser
Garden Grove, IA

A: No, but there are several programs just like it or possibly better. They range from Calc Result-Advanced (Handic Software, Mt. Laurel, NJ) and Multiplan (HES, Brisbane, CA), at the high end of cost and features, to Easy Calc (Commodore, West Chester, PA), PractiCalc (Computer Software Associates, Newton, MA) and BusiCalc II (from Skyles Electric Works, Mountain View, CA) at the low end of cost and options, but all are at least as good as VisiCalc on the PET. Any of them should satisfy most users.

Q: I recently purchased VIP Terminal from Softlaw Corp. for the 64. On attempting to download programs written in the universal subset of Basic from a friend's Apple, I found it will save files only as sequential disk files. Do you know of any way to convert sequential files into loadable program files?

Robert Levinson
Brooklyn, NY

A: Some of Softlaw's competitors can do it—Telstar 64 from Eastern House Software (Winston-Salem, NC) downloads such information directly as programs, and Smart 64 Terminal from Microtechnic Solutions (New Haven, CT) can save it as sequential files, and then convert it into a program later with a separate program. Similar utility programs are available from some user groups.

Another method is to use the XEC (Execute) command of Power, the programmer's aid from Pro-Line Software (Mississauga, Ontario, Canada). It reads a sequential file and treats it as characters typed on the keyboard. In your case, it will enter the file into memory as a program. Then you simply save it to disk.

Q: With an appropriate EPROM cartridge to match the 64, can I use the VIC Hamtext EPROM with the 64?

Robert Schmidt
Moore, OK

A: Probably not as it is, because most ROM memory locations and I/O hardware locations were moved in changing from the VIC to the 64. That's also why the shape of the cartridge was changed—to keep you from confusing them.

Kantronics may have a 64 version now, and possibly a trade-in policy. If not, a machine-language programmer, with an EPROM burner and an empty cartridge for the 64, could possibly convert the program for you.

Q: Does the MAE assembler from Eastern House utilize standard MOS terminology? A review in *Compute!* magazine seems to indicate it does not.

Why is MAE better than PAL? I realize it has macro capability. Is that all? How about some of the newer assemblers on the market? Where can I get an unbiased opinion?

Joseph Faust
Lompoc, CA

A: MAE is only nonstandard in one important way. Instead of automatically using Zero-Page mode whenever possible, like the CBM assembler and PAL, it uses it only when you explicitly request it by adding an asterisk before the operand.

Carl Moser, author of MAE, feels this allows more flexibility because it allows long addresses in zero page, but his way does cost extra bytes when you forget to include needed asterisks.

The only thing I dislike about PAL is that instead of automatically tabbing the four fields of an assembly source listing to the proper column during editing, like Commodore's assembler and MAE, it leaves them unformatted until the actual assembly.

There are good reasons for this, but it makes a PAL source file very difficult to read until it is assembled. Either that or you must insert the spaces manually, which adds dramatically to the space and programming time required. On the other hand, PAL can handle truly huge source files all at once.

I use both MAE and PAL regularly, as well as Commodore's assembler, and consider the authors of all three to be personal friends.

Finding an unbiased opinion will be difficult, as we all have biases. The only opinion that finally counts is yours.

Q: You are my last resort...all other efforts to find a bulletin board system (BBS) program have failed. If you or any of your readers know where I can find one to run on a VIC with 32K memory, 80 characters per line, 1541

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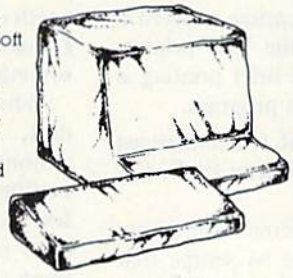

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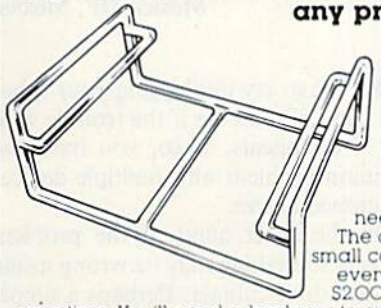

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A: Suitable BBS programs do exist, four of them at my last count. Two that have been tested successfully are the Electric Magazine and Softboard. Bob Shannon, author of the original version of Electric Magazine, has also kindly offered to send his monthly SYSOP's newsletter to the SYSOP of any Commodore bulletin board who requests it, even if you are not among the 200 users of his particular program. His address is 33175 Ocean View Drive, Ft. Bragg, CA 95437.

Q: If I decide to keep my Commodore, I intend to subscribe to *RUN*—I think it's an excellent publication. However, I have written and called Commodore, and the information they promised to send has never arrived. You are my last resort!

When I bought my 1541 disk drive, I loaded the test disk, ran it, typed NEW and went on to something else. The next time I ran it, everything was gone. I still don't understand what happened, since typing NEW shouldn't have affected the disk!

My request is simply to get another test disk. Can you help me?

Elaine Pugh
Whitefish, MT

A: Sure, no problem. Just send me the dead one, and I'll rerecord it for my usual $15 copying fee, after checking to see if anything else may be wrong.

As for how it happened, New is also a command to the disk, but its syntax is difficult enough that you aren't likely to have used it successfully by accident, especially not without the wedge active. More likely, you turned the disk drive off or on with the disk in place and the door latched. This can and often will trash a disk.

Another possibility is that your disk was exposed to a magnetic field, such as a ringing telephone, between your first and second use. If so, rerecording the disk will take care of it.

Hardware

Q: I use a Commodore 64, two 1541 disks (unit 8 and 9), a 1525 printer (unit 5), a Brother HR-15 parallel printer and a Card/? interface to HR-15 (unit 4). I use an on/off switch on the connection box for control. Of prime concern is the lockup caused by the 1525 printer. This occurs whenever a brief printing is made while developing a program.

R.J. Prendergast
Buena Park, CA

A: Lockup problems sometimes happen in Commodore 64 setups that include several devices on the serial bus. There are lots of published suggestions about the proper order in which to turn the various pieces on and off (all different), but if these fail, you may need to unplug (or at least turn off) one or more of the other devices on the bus before you use the 1525.

If your 64 does not have the current Kernal 3 ROM, *The Transactor* magazine suggests that updating it might improve matters, because the Kernal 3 chip modifies serial bus timing to allow for several chained peripherals. To see whether you have Kernal 3, type:

```
? PEEK(65408)
```

If you have Kernal 3, the number 3 will be printed when you press the return key. If not, a full-service Commodore dealer may be able to order one for you.

Q: When I hooked my 64 to the color TV, the screen was twisted and could not be read. I needed a horizontal hold control for correction, but my TV only has a vertical hold control.

For the past year I have been using a B&W TV that has a horizontal control but is missing all the pretty colors. Is there some way to control the horizontal on the 64?

Joel Berman
Haddonfield, NJ

A: Don't give up too quickly on your TV. The horizontal hold command may be hidden—accessible only through a hole or by removing the back of the set entirely. Find someone who repairs that brand of TV and have them check into it. If you have a schematic for the set, it may be listed there.

Q: I have had a 64 with two disk drives for about a year now. I have already solved the common overheating problem by installing a small fan underneath every device. About a month ago, I noticed that my #9 drive started doing something abnormal.

When it is on, reading or writing a disk, both lights suddenly go off, although the drive motor continues working (at least the disk is rotating). A few seconds later, a Device Not Present error message appears on the screen. Is there any way I can fix it? Help relating to Commodore computers is not available here in Mexico.

Leon Esquenazi
Mexico DF, Mexico

A: First, try unplugging your other disk (unit 8), and see if the trouble with unit 9 disappears. If so, you have the common problem with multiple devices mentioned above.

On the other hand, if the problem persists, something may be wrong inside the disk drive cabinet. Perhaps a simple wire is slowly working loose or a chip is working its way out of a socket. Make sure everything is in place.

If that doesn't do it, try swapping the removable chips between the good and bad disks. If one is bad, moving it will make a difference. If all that fails, see if you can send the unit to Commodore for a replacement, as people do here in the U.S.

Q: I am using an older Gemini 10 printer and Cardco's +G interface. I set the switches according to the manual, but I cannot get program listings to print equivalents to Commodore's graphics symbols.

I was using the Card/?-A interface, but Cardco said that I must use the +G to print the 64's graphics. Now they say I must upgrade the printer's ROM. What gives?

Michael Conley
Bell, CA

A: What you want to do couldn't be done at all on non-Commodore

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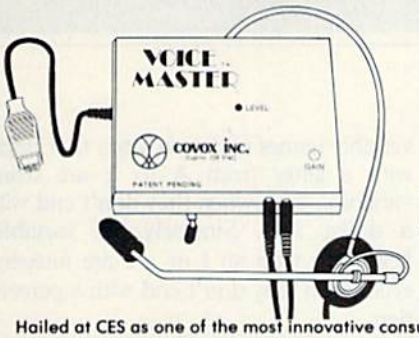

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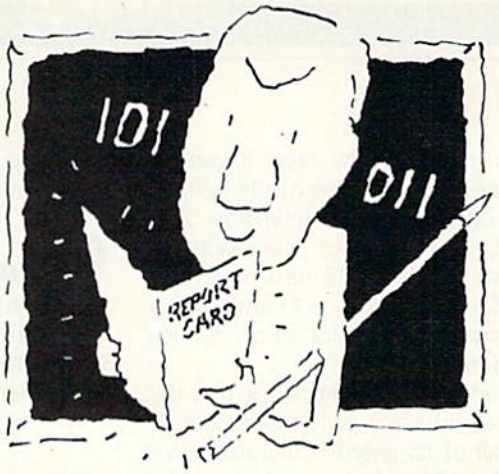

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printers until recently. Now it can be done, but only on a few of the best recent models of both interfaces and printers. The graphics enhancements that turn a Gemini 10 into a 10x are what allow the Cardco +G interface to do a convincing imitation of a Commodore printer.

Similarly, even if you had a 10x, the Card/?-A interface isn't smart enough to use all of its graphics features automatically within a listing, and it must be upgraded.

Cardco isn't putting you on. If you want the graphics badly enough, you'll have to get the new printer ROM.

Q: I have both a 64 and a VIC. Since the 64 has better games, I don't get much time to use it with my whole family at home. Can I type a program on my VIC, save it on tape, take the tape to my 64 and load it there?

Yosef Guttman
Scranton, PA

A: Yes. And nice to hear your computers are well used.

Q: I have seen a lot of ads for a 25K VIC-20. Is there any way I could run programs on it written for unexpanded, 8K or 16K VICs?

Arturo Servin
Le Grand, CA

A: A VIC's a VIC. All come with 5K RAM, 14K ROM, a 2K character-generator ROM and a bit of screen memory. A while back, Lechmere's of Boston made national headlines by throwing in a memory expander and advertising as though its VICs were a new model. I think this is what the ads you see are doing. The one you enclosed mentions "16K level II Microsoft Basic." The rest of the world calls it Basic 2 and knows it as an 8K Microsoft Basic, with extensions bringing it and its operating system to a total of 14K.

I've added up the memory several different ways, and I can't come up with 25K. I assume your ad is counting the ROM as RAM and throwing in at least a 3K memory expander, possibly a larger one. If this is the case, this so-called 25K VIC will run ordinary VIC programs as soon as you unplug the included memory expander.

Q: Has the Commodore 8250 two-megabyte dual disk drive been proven in the field and is it superior in reliability to the 1541? Will it run the standard disk programs, such as Flex File?

Dale Seppa
Virginia, MN

A: I've had my 8250 for almost two years, without repair or maintenance. Lincoln College here has had one for over a year, also without trouble. My copy of Flex File for the PET works with it. However, most programs for the 64 come on 1541 disks, which are not format-compatible with the 8250, and those which are DOS-protected cannot even be copied onto an 8250 disk.

Q: Does the 64 really ruin your color TV set?

Jimmy Davis
Chicago, IL

A: No, it hasn't ruined mine, and I've used it with the 64 for almost two years now. Just turn them both off when you're done using them.

Programming

Q: I have need of a word-scrambling program that will print all combinations of a word. I found just such a program in a primer, but the second line contains DEFSTR and DEFINT. These statements appear not to be part of Commodore Basic, and *Lien's Basic Handbook* presents no alternative. Please send aid.

R.G. Tischer
Starkville, MS

A: DEFSTR and DEFINT stand for "define string" and "define integer," respectively, and their only purpose is to save space in a program. For example, you might see a line like this:

```
2 DEFSTR A-E:DEFINT I-J
```

What it means is that from then on, all variable names in the program that begin with a letter from A to E are string variables, even when they don't end with a dollar sign. Similarly, all variables beginning with an I or a J are integers, even when they don't end with a percent sign.

To convert programs that use these shortcuts into Commodore Basic, simply add a dollar sign ($) to the end of each variable name covered by the DEFSTR statement and a percent sign (%) to the end of each name covered by DEFINT, and omit the DEFINT and DEFSTR statements.

As usual, there is an exception—if a variable name already ends in a dollar or percent sign, leave it alone. Explicit declarations like that take precedence over DEFSTR and DEFINT.

By the way, a similar program for Commodore Basic appeared in *Recreational Computing* (RIP) about four years ago, and should still be available, under the name "Jumble," from many user's groups.

Q: I have a fairly complex Basic program that incorporates some machine language loaded through LOAD "NAME",8,1. The problem: While such a file loads on first power-up, it may not load after some editing of a resident file. That is, LOAD A, EDIT A and LOAD B will give this result: Data from B is loaded all right, but the disk drive does not shut off and return control. What a pain!

Joel Schneider
Children's Television Workshop
New York, NY

A: The problem may have to do with the finer points of chaining from one program to another in Commodore Basic. There are at least three problem areas to consider.

First, after a Load command within a Basic program, the program re-executes from the first line of whatever program is in the Basic workspace after the program is loaded, but without erasing existing variables. It is as though the program began with line 10, and contained the following line:

```
900 LOAD"B",8,1:GOTO 10
```

Commodore Basic will not actually even see the GOTO statement, because

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it will have already started over again from the start (line 10).

Second, if your program loads other Basic programs, all such loaded programs must be shorter than the first program, or they will load on top of its variables. Since the variables are not cleared by the new load, they will now point within the new program itself, and contain who knows what.

Finally, if you are not careful to protect your machine language program from Basic, it is possible it will either be destroyed by Basic's variables or load in on top of them, destroying them.

Q: Could you inform me of any creditable organizations that confer college credit through the use of a Commodore computer?

Ron Erickson
Shenandoah, IA

A: My opinion is biased, of course, since I teach at one—Lincoln College in Lincoln, IL. It is a two-year college with an accredited liberal arts program that includes several courses in computer science, all of them taught on Commodore computers.

We have just added a second Commodore computer lab, composed entirely of 64s, and we also have an annual Commodore summer camp for adults, a one-week intensive course led by several well-known experts in the use of Commodore computers. Those who wish college credit from the camp can earn two semester hours of credit for their work during and after the camp week. Whether your interest lies in attending a college or next summer's camp (tentatively scheduled for June 23–29, 1985), Lincoln College will be glad to hear from you.

Q: One thing I just don't seem to be able to get right on my VICMON cartridge is the Save command. If I just save a piece of memory, it will work all right, but if I want to save with the non-relocate flag (,1), I only get that infernal question mark. The syntax I am using is:

```
.S "GAME",08,5000,5050,01
```

Am I doing something wrong?

Tim Pears
Sparks, NV

A: Yes, you're trying too hard. You don't need to add the non-relocate flag (,1) when you save a program. That flag is only needed when you load the program back into the computer, and you don't want it moved. Your example should be:

```
.S "GAME",08,5000,5050
```

Updates

***Update:* This is in regard to loading and saving the wedge in the July issue. Load and run this DOS creator, and voila, DOS 5.1 will be on your disk!**

```
10 IF A=0 THEN A=1:LOAD "DOS 5.1",8,1
20 IF A=1 THEN SYS 52224
30 INPUT"ENTER Y WHEN BLANK DISK
   IS IN DRIVE";YS
40 IF YS <>"Y" THEN 30
50 POKE 43,255:POKE 44,203
60 POKE 45,90: POKE 46,207
70 SAVE "0:DOS 5.1",8
80 POKE 43,1:POKE 44,8
90 NEW
```

Ralph Lees
New York, NY

Notes: Your program works well (despite my changes). Just remember to start out with the Test/Demo disk in the drive and a formatted disk nearby. If you want to use it, I suggest you have the Basic portion (C-64 wedge) already loaded and saved as the first program on the receiving disk. When you type RUN, the wedge will be loaded in, and you'll be prompted to put in the blank disk. Then the machine-language portion of the wedge will be saved on it.

***Update:* To print a copy of the screen on the 1525 or 801 printer using the program in Appendix "B" or the manual (April), alter the 222 to 40 in line 60060.**

Allan Burdekin
Morley, England

***Update*: Here is a procedure concerning the 64, Easy Script, the Gemini 10x and the Connection interface:**

1. There are two switches under the lower right-hand corner of the label on the Connection. Turn both off.

2. Load Easy Script.

3. Select the MX 80 printer, then Serial.

4. Now press F3 and the return key, followed by sa7 and the return key. This establishes a secondary address of 7, needed for lowercase.

Following are some commands that are not clear in the manual. Use F1, then use:

- **[to turn on expanded print;] to turn it off.**
- **; to turn on underlining; : to turn it off.**
- **& to turn on emphasized print; % to turn it off.**
- **(to turn on bold face;) to turn it off.**
- **< to turn on compressed print; > to turn it off.**

Up arrow is the escape key, CHR$(27). To set up italics, use ASCII codes.

Robert Callard
Ardmore, PA

***Update:* Contrary to your position on the matter (July), the cursor is precisely a character, a reversed space, to be specific! The following simple program will produce a happy-face cursor.**

```
100 REM CUSTOM CHARACTER DEMO
110 POKE 52,48:POKE 56,48
120 POKE 56334,PEEK(56334) AND 254
130 POKE 1,PEEK(1) AND 251
140 FOR I=0 TO 2047
150 : POKE I+12288,PEEK(I+53248)
160 NEXT
170 FOR I=13568 TO 13575
180 : READ A
190 : POKE I,A
200 NEXT
210 POKE 1,PEEK(1) OR 4
220 POKE 56334,PEEK(56334) OR 1
230 POKE 53272,28
240 DATA 60,66,165,129,165,153,66,60
```

Jim Bernard
Springfield, VA

A: Nice try, and I've included your demo because it illustrates how to make a custom character. However, it is not a true new cursor.

Move your happy face on top of any character other than an unshifted space (a shifted space will make this most obvious), and it will disappear and be replaced by the familiar flashing square. You've simply given a custom definition for a character often found under the cursor.

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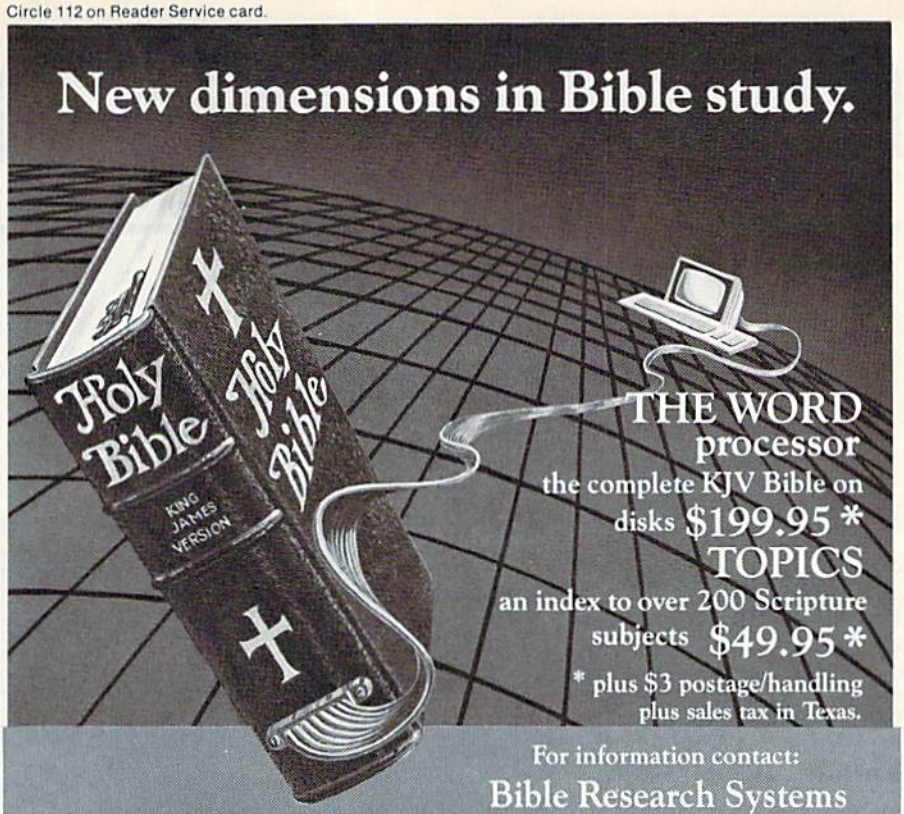

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Book Gallery

Compiled by Shawn Laflamme

The VIC-20 for Kids Of All Ages

Tony Noble
John Wiley & Sons, Inc.
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New York, NY 10158
Softcover, 153 pp., $10.95

Tony Noble is a parent and teacher. It is no wonder then, that he has chosen to write a beginner's programming guide such as this. *The VIC-20 for Kids of All Ages* is written for computerists ranging approximately from sixth grade to junior high. As a result, it is an excellent choice for your children, and its unimposing nature also recommends itself well to adults.

Seven chapters span the text of this book. Each of the seven chapters is a stepping stone to better Basic programming. Chapter one is a brief overview of the growing need for computer use and understanding in the education process. Chapter two is an introduction to the structure and jargon of computers.

Chapter three gives you 29 programming steps; each of these steps builds on the ones prior to it, and each introduces a new programming concept and/or Basic keyword. Some of the concepts covered are variables, input and output, color, graphics, subroutines, music and conditional execution. Each of these programming lessons is one and a half to two pages long.

In the fourth chapter, Noble attempts to hone the skills presented in chapter three until the reader has a firm grasp of some advanced Basic concepts, such as branching, subroutines and direct memory manipulation using Peeks and Pokes.

Chapter five introduces flowcharting and program design. Using two educational programs as examples, Noble shows how to transfer ideas to actual programs. These ideas are supplemented in chapter six, which covers researching and implementing simple simulations as educational programs.

This is an excellent book for children, and its unimposing nature recommends itself well to adults.

Chapter seven is a collection of listings of educational programs, covering a variety of subjects such as phonics, math and geography.

As mentioned, the text is unimposing, and it's excellent for beginning programmers. My only complaint is that the tables for graphics, the flowcharts and sketches throughout the book have a hand-drawn look to them. This is acceptable at times, but using so many of them causes the book to appear too cute for my personal taste. Outside of this, the book is a good beginner's guide, especially for that young, aspiring programmer in your home.

Thomas Franks
Wadsworth, OH

Anatomy of the Commodore 64

Michael Angerhausen, et al.
Abacus Software
PO Box 7211
Grand Rapids, MI 49510
Softcover, 291 pp., $19.95

In the *Anatomy of the Commodore 64*, the authors have done an excellent job of detailing the inner workings of the C-64. This book is not oriented toward the newcomer to the computer field. For example, the very first chapter is about machine language programming. However, the experienced programmer or hardware experimenter may find lots of useful information in this book.

Assembly language programming is discussed in chapter two: methods of performing certain Basic functions (such as SQR) in assembly language are given, along with the logic involved. A full presentation of this language is beyond the scope of the book, but enough information is presented here to give you a better grasp of the more detailed information in the following chapters.

Chapter three discusses the operating system, memory management and the expansion and user ports of the Commodore 64. This information can also be found in the *Commodore Programmer's Reference Guide*, but it has been rearranged and compiled by the authors into a format somewhat easier to understand.

Chapter four gives a very comprehensive overview of the SID (Sound Interface Device) chip. Here again, information has been compiled in a manner readers may find more useful than the purely technical details given in the reference guide. One interesting sidelight of this chapter is the use of the POTX and POTY analog to digital converters

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within the SID chip: It's refreshing to see a nuts-and-bolts method outlined. Connection of a potentiometer to the joystick ports is also discussed.

The next chapter details some of the ways in which Commodore engineers were able to jam so many nice features into one microcomputer. One of the keys in doing this was the VIC (Video Interface Controller) chip, which not only produces the pictures on the screen, but also handles the refreshing of 64K of dynamic memory. An exhaustive discussion of sprites will also be found here, including an assembly language program to simplify graphics programming.

A guided tour of the Basic interpreter is given in chapter six. Methods of creating your own extended Basic are discussed. Assembly language routines are also given, which will allow you to do such things as print out a hardcopy of Basic screen text, renew a program and employ the Print Using command, which formats numeric output. The USR function is discussed, and example routines are given that allow much faster and more precise SQR, SUM and PROD functions than their Basic equivalents.

The next chapter compares the ROM addresses of the VIC-20 with those of the C-64. Also discussed are some of the things to look for in converting VIC-20 and PET/CBM programs to formats the C-64 can use.

Chapter eight tells you all you ever wanted to know about the CIA (Complex Interface Adapter) chip. This is a new peripheral chip allowing the C-64 to "handshake" other input/output devices, such as printers and modems. A couple of short routines are given which allow you to fine-tune the TOD (Time Of Day) clock, resulting in more accurate timekeeping. Also, the interaction of this chip with the keyboard and the joysticks is discussed.

Appendix A consists of 149 pages of ROM listings, given in a disassembled format. I have several different memory maps, but with this appendix, I can determine the actual logic used in performance of various Basic functions, should the need arise. But going way beyond the disassembly of the Basic interpreter, this appendix gives you the various keyboard-decoding tables, I/O routines and much more.

One flaw I noticed was typographical errors. Somehow, in translation from German to English, quite a few errors crept in.

I would highly recommend this book to anyone striving to learn more about the technical aspects of hardware interfacing and methods of programming. The price is right, and the ROM disassembly will prove to be a useful tool to those who can study it and integrate it into their programming.

Dan Linscheid
Sheridan, OR

Commodore 64 Games Book

Clifford and Mark Ramshaw
Melbourne House Software, Inc.
347 Reedwood Drive
Nashville, TN 37217
Softcover, 192 pp., $14.95

Commodore 64 Games Book was one of the first game books introduced for the Commodore 64. Several others have followed, but few surpass this one. If you want games and lots of them, then this is your book.

The book contains 30 game programs. They won't help you balance your household budget, but they might help you to relax after the frustration.

Remember how much fun Space Invaders was when you dropped your first quarter into that early video game? The Ramshaw's have included a very good version in the book.

Have you ever wanted to try one of those flight simulation games, only to find that the price was out of your reach? A flight simulator is included here.

How about a tank battle game? There's Tank Attack. For those who like to play the ponies, there's Horse Racing. There's even one crazy game where you are a waiter trying to bounce a flying turkey off your serving platter.

My favorite is U.F.O. You fly a jet fighter against an invading flying saucer. The trick is to stay above the U.F.O. and hit it with the guided missile. If you hit the saucer, it splashes into the ocean below. If you let it get above you or past you, it's the deep blue for you.

The programs make good use of the C-64's sound and graphics. There are plenty of sprites, and color is used freely.

All the listings are in Basic, but also included are lots of fast machine language routines. This gives most of the games the speed and feel of quality arcade games.

The listings use Commodore graphics symbols, which may confuse novice programmers. But the graphics characters are well printed and easier to identify than those in other books I've seen. A table is included to help the novice programmer identify and use the symbols.

To help you debug a listing, the authors identify most of the variables in each listing. An explanation of what the various blocks of program lines do is also included. These tables should help you to avoid long searches for errors. I also found it educational to use this information to change selected variables, just to see what effect it would have on the program. In U.F.O., the ocean can be made to appear three-dimensional simply by duplicating a couple of lines in the program.

The machine language routines really help the games, but they can be painful to debug. Since these routines often redefine the graphics display, error messages may be invisible or unreadable. Or even worse, the program could lock up. So, be very careful when typing in the listings, and be sure to save them before the first run.

The Ramshaws use the keyboard to control the action in each game. Most gamesters would probably prefer the use of a joystick. Appendix B explains how to convert the games to joystick use. I found this educational, but it can also be rather frustrating.

This book will add lots of good games to your collection. For programmers, the notes and hints included are very educational.

At $14.95, this book, though not inexpensive, is comparable to other computer-related paperbacks of similar size. When you translate that to about 50 cents per program, the price seems very reasonable.

Gary V. Fields
Asheville, NC

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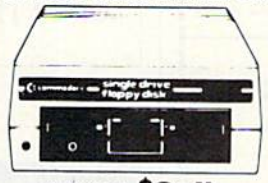

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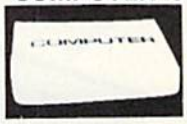

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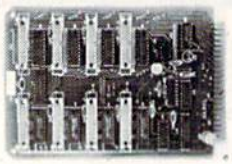

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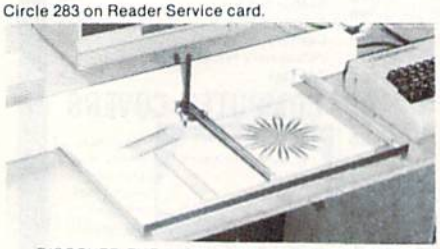

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RUN Amok

Item: In trick $C9 of the August Magic column, *2↑XA should read *2↑X:A

Item: There is a bug in the joystick version (Listing 2) of the Super Sprite Builder program (p. 82, July). It is caused by Basic's handling of the ASC function when it is applied to an empty string. To prevent an "Illegal Quantity Error in line 150" message, line 127 must be changed as follows: 127 IF JV OR FR THEN A$="Z":GOTO 140

Clubs

Bay City, MI

Tri-Cities User's Group (TCUG) is based in Bay City, MI and has a membership of 120 persons.

If interested, contact Tri-CUG, c/o Mark Meyers, PO Box 45, Bay City, MI 48706, 517-893-6999.

Pocatello, ID

Anyone interested in Commodore computers and living in the Pocatello, ID area can contact Gary R. North, (President), Pocatello Commodore User's Group, 82 Mountain Drive, Pocatello, ID 83204.

Coastal Maine Area

The Coastal Commodore Club is based in the coastal Maine area. If interested, contact Chris Elliot (chairman), Coastal Commodore Club, Waldoboro Village–Apt. 19, Waldoboro, ME 04572.

Kankakee, IL

The Kankakee Hackers is a Commodore user's group serving the greater Kankakee, IL area. This 100-member group has a software library containing over 1000 programs, a monthly newsletter called the Hacker Rag and a computer bulletin board system that is available for members to use. The annual membership fee is $15, which includes all members of a family. Meetings are held every second Thursday, at 7:00 PM, at the City National Bank (on the fourth floor).

General meetings are open to the public and focus on the interests of beginning and intermediate computer users. Special interest groups also meet regularly (open only to paid-up members).

For information, contact Rich Westerman (newsletter editor), RR 1, Box 279, St. Anne, IL 60964, 815-933-4407.

Oswego, NY

The Oswego 64 Users serves the Oswego, NY area and meets on the second Tuesday of the month, at 7:30 PM, in 203 Park Hall (on the State University College, Oswego campus).

For more information, contact Dr. John R. Boronkay (associate chairman), 208 Park Hall, Dept. of Industrial Arts and Technology, State University College, Oswego, NY 13126, 315-341-3010.

Mohawk Valley, NY

The Mohawk Valley Commodore User's Group was founded to assist be-

ginners in obtaining solutions to their computing problems. Membership is $5 annually. Meetings, which are open to the general public, are held on the second Tuesday of the month, at 7:00 PM, at the Clara S. Bacon School (Henrietta Blvd., Amsterdam, NY 12010).

For information, contact William A. Nowak (Club President), PO Box 343, Tribes Hill, NY 12177, 518-829-7576.

Livermore, KY

The Commodore Computer User's Group (PALS) meets on the third Wednesday of each month at 7:30 PM, at the Almond Ave. Elementary School in Livermore. Everyone is invited to attend the meetings, at no charge, to take advantage of software and hardware demonstrations and general computer talk.

For more information, call 415-443-8497.

Baltimore, MD

BAY-CUG (Baltimore Area Commodore User's Group) was recently formed, with membership including both C-64 and VIC-20 users. Meetings are held on the fourth Wednesday of the month at the Loch Raven Senior High School.

For information, contact Michael M. Broumberg, 4605 Vogt Ave., Baltimore, MD 21206, 301-325-2156.

Heidelberg, Germany

U.S. military personnel and civilian employees of the military (and their dependents) who are stationed in the Heidelberg, Germany, area, are invited to join the recently-organized Commodore Computer User's Group.

For more information, contact Commodore Computer User's Group–Heidelberg, PO Box General Delivery, APO New York, NY 09102.

Dublin, Ireland

Club64, a C-64 software user's group based in Dublin, Ireland, is interested in hearing from Commodore users who are unable to attend user's club meetings (because they are living in remote areas, they are disabled, or they simply do not have the time). As the group has not yet decided on the range of services it will provide, constructive suggestions are welcome.

All C-64 users (with disk drives, as programs are not yet available on tape) are invited to make use of the group's library of public domain software. Anyone wishing only to use the library does not have to pay a membership fee, and is only required to cover the cost of the disk, packaging, mailing and so on.

Club64 is interested in obtaining news, product details, programs and other suitable information for its forthcoming disk newsletter.

For more information, write to Brendon Conroy, c/o Upper Drumcondra Road, Dublin 9, Ireland.

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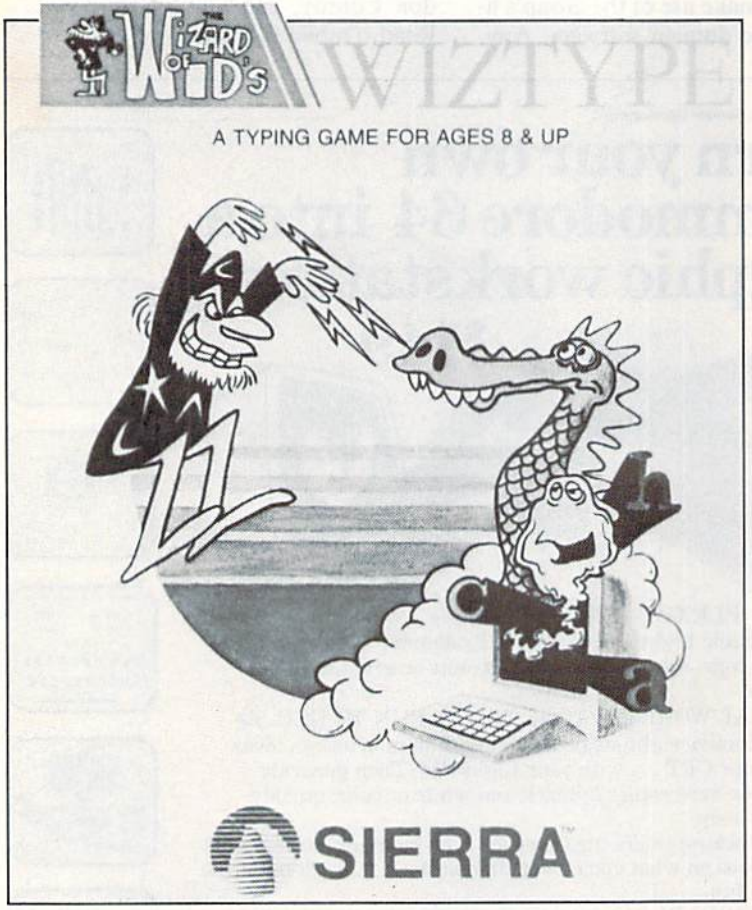

The Time Machine

Imagic (981 University Ave., Los Gatos, CA 95030) has released The Time Machine, based upon the classic novel by H.G. Wells.

You will enter the deadly time tunnel, with its fierce storms, and travel to the futuristic world of the Eloi. You must then attempt to rescue Weena from the Morlocks.

The Time Machine is available on disk for the Commodore 64. It retails for $34.95.

Check Reader Service number 400.

Tropical Adventure

MicroLab (2699 Skokie Valley Road, Highland Park, IL 60035) has released Death in the Caribbean for the Commodore 64.

The game puts you in search of mysterious treasure on a tropical island. You will encounter terrifying pitfalls and challenging problems as you try to stay alive and find the treasure. The package includes a map of the island to help you keep track of your journey.

Death in the Caribbean is available on disk for $35.

Check Reader Service number 412.

Wiztype

Sierra (Sierra On-Line Building, Coarsegold, CA 93614) has released Wiztype, a new release in the Wizard of Id series, based upon the comic strip by Johnny Hart.

Wiztype is designed to teach basic typing and keyboard skills. You must type letters or words as fast as the Spirit can create them. If you're successful, the Wizard gleefully zaps the Spirit with a lightning bolt. If you type too slowly, the triumphant Spirit turns into a dragon and destroys the Wizard with a burst of flame.

Bung, the king's jester, also makes an appearance in Wiztype. The game includes several different practice drills and scorekeeping, and it is programmed to teach typing skills at any level.

Wiztype, for the Commodore 64, is available for $34.95 on disk and $39.95 on cartridge.

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Explore the World of Music

Bank Street Musicwriter is a software package that allows you to explore musical concepts and compose music.

The program allows you to use the computer keyboard to arrange notes on two musical staffs that are visible on the screen. As the note is entered, it appears on screen and the sound is heard. Four voices (soprano, alto, bass and tenor) can be programmed and played simultaneously.

Eight editing modes allow you to save and print your music for future editing or listening.

Bank Street Musicwriter is available on disk for the Commodore 64. Retail price is $49.95. Mindscape, Inc., 3444 Dundee Road, Northbrook, IL 60062.

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A Home for Your Computer System

Tech Systems Co. (PO Box 968, Palo Alto, CA 94306) has introduced the CAB-64 and CAB-20 computer system cases, designed to house all major system components of the C-64 and the VIC-20 in one compact case.

The aluminum cabinet holds the computer, power supply, disk drive and a cartridge or interface. A monitor or printer can be placed on top of the cabinet for eye-level viewing. Also included are front-panel main power and disk drive electrical controls and indicators for a four-outlet power strip.

The cases provide left- or right-side disk insertion and a push-in storage area for the computer when it is not in use. Ventilation is provided by the thermal design. The cases retail for $95 each.

Check Reader Service number 417.

Match-Wits

Match-Wits is a programmable family game of concentration and memory, based on the old TV program Concentration.

The object of the game is to match pairs of preprogrammed word sets in categories such as cities, sports, famous people, numbers and animals.

Whenever a player correctly matches a pair, a portion of a picture puzzle is revealed. The player who identifies the picture first is the winner.

You can create and program your own categories, such as historical facts, family members' birthdays and rock stars.

Match-Wits is available on disk for the Commodore 64. It retails for $29.95. CBS Software, One Fawcett Place, Greenwich, CT 06386.

Check Reader Service number 410.

Write Your Own Computer Games

Action Writer is a software package that allows you to write arcade-style games without prior knowledge of computer programming.

The program allows you to write games that incorporate action, movement, color and sound. It lets you exploit the capabilities of your computer.

The Action Writer package, including a comprehensive manual, is available on disk for the Commodore 64. Retail price is $49. CodeWriter Corp., 7847 N. Caldwell Ave., Niles, IL 60648.

Check Reader Service number 411.

Rock n' Rhythm

Rock n' Rhythm lets one to three players take over a recording studio and record songs. Players can write their own music or re-create their favorites and then perform them by playing the drums and the bass keyboard.

To make sure that the recording session goes smoothly, the program allows one of the players to be the recording engineer. The recording engineer puts one track on at a time and edits the piece to get it just right.

Changing the musical arrangement of a song can be done by recalling it from the jukebox in which it is stored. You can change the melody, tempo or rhythm.

Rock n' Rhythm is available on disk for the Commodore 64. It retails for $39.95. Spinnaker Software, 215 First St., Cambridge, MA 02142.

Check Reader Service number 413.

Be a Hero!

In H.E.R.O., a volcano honeycombed with tunnels has been jarred by a rupture in the earth's surface. Miners are trapped by rockslides; glowing magma deposits and a river of molten lava have ruled out traditional rescue methods. With time running out, the authorities have turned to R. Hero.

R. Hero, well-known as the founder of Helicopter Emergency Rescue Operations (H.E.R.O.), is a resourceful, inventive and fearless rescue expert. Strapped to a Prop Pack, he flies through glowing mine shafts like a human helicopter on his mission to rescue the miners. He encounters bats, spiders, snakes and moths, which he must destroy with micro beams from his laser helmet. A tentacled beast in a boiling river also awaits him.

The Commodore 64 version of H.E.R.O. is available on disk for $31.95 and cartridge for $34.95. Activision, Inc., 2350 Bayshore Frontage Road, Mountain View, CA 94043.

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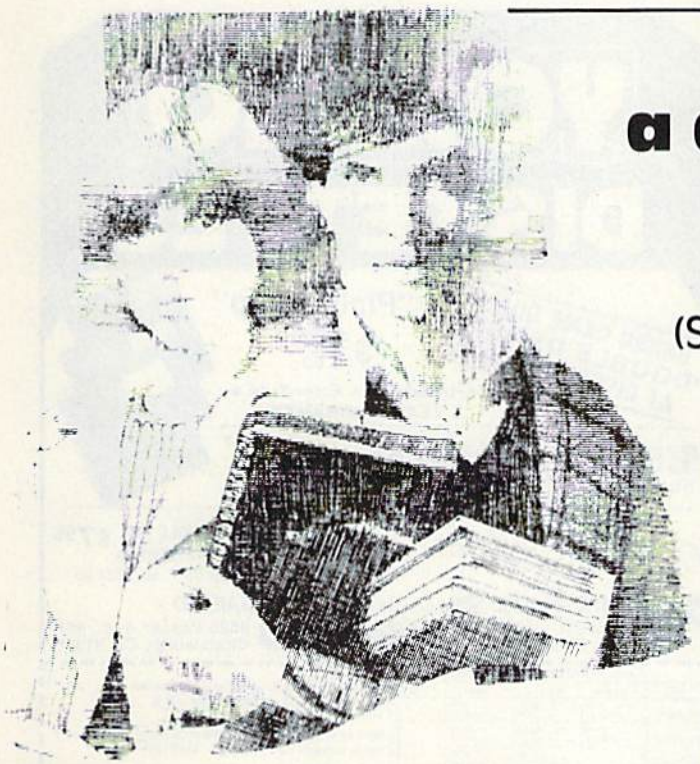

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Montezuma's Revenge

Montezuma's Revenge is an action and adventure game from Parker Brothers (50 Dunham Road, Beverly, MA 01915).

You must assume the role of Panama Joe, a daredevil adventurer, and fight your way through 100 interconnected chambers in search of Montezuma's treasure trove.

On your way through this vast Aztec fortress, you will encounter narrow ledges, fire pits, yawning gaps, speeding conveyors, locked doors, laser bridges and more. The fortress is also infested with ghosts, deadly spiders and poisonous snakes. You will have to obtain keys and other objects helpful to your quest.

Montezuma's Revenge is available on cartridge for the Commodore 64. Retail price is $30.

Check Reader Service number 405.

Raid Over Moscow

In Raid Over Moscow, the Soviet Union has launched a nuclear attack on major cities in the United States and Canada.

The U.S. can stop the attack by destroying the Soviet Defense Center. American stealth bombers, capable of flying in Soviet airspace without being detected, are the only hope for the U.S.

As squadron leader, you must lead your commandos on a virtual suicide mission into the Soviet Union. You must first knock out Soviet missile launch sites and then proceed into Moscow to destroy the Soviet Defense Center.

Raid Over Moscow is available on disk or cassette for the Commodore 64. It retails for $39.95. Access Software, Inc., 925 East 900 South, Salt Lake City, UT 84105.

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Melody Magic

Melody Magic is a music composition program written for children and adults who wish to take the first step toward learning music.

The documentation teaches you how to read melodies from sheet music so that you can enter melodies into the program. A sheet music book is also included, containing over 20 famous melodies. You can also compose your own music.

The program will teach you the basic concepts of music theory, including the musical scale, counts (beats), signatures (flats, sharps and naturals), rests and octaves.

Melody Magic, for the Commodore 64, is available on disk for $34.95. Swearingen Software, 6312 W. Litte York #197, Houston, TX 77088.

Check Reader Service number 407.

Playwriter Series

Woodbury Software (15 Prospect St., Paramus, NJ 07652) has released the Playwriter Series for the Commodore 64. The programs allow children ages seven through fourteen to write, edit, illustrate, print out and bind their own hardcover books.

Playwriter asks the child a series of questions; each of the child's answers reveals another facet of the story. After the story has been written, Playwriter's word processor lets the child change any part of the story. Next, the child can print out and illustrate the story using the color stickers and illustrations included in the package. A hardcover jacket is also provided.

The first two packages in the series are Adventures in Space (a fantasy adventure through time and space) and Tales of Me (an autobiographical fantasy where the child is the center of the story). Each package in the Playwriter series is available on disk for $39.95.

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Learn with Socrates

The Arrakis Advantage is a new family of educational software from Prentice-Hall (PO Box 819, Englewood Cliffs, NJ 07632).

The programs are designed for students in grades seven through twelve. The initial programs in the series include Algebra, Geometry, Biology, Chemistry, Physics and Statistics. All programs in the series are based upon research and analyses of current curricula across North America.

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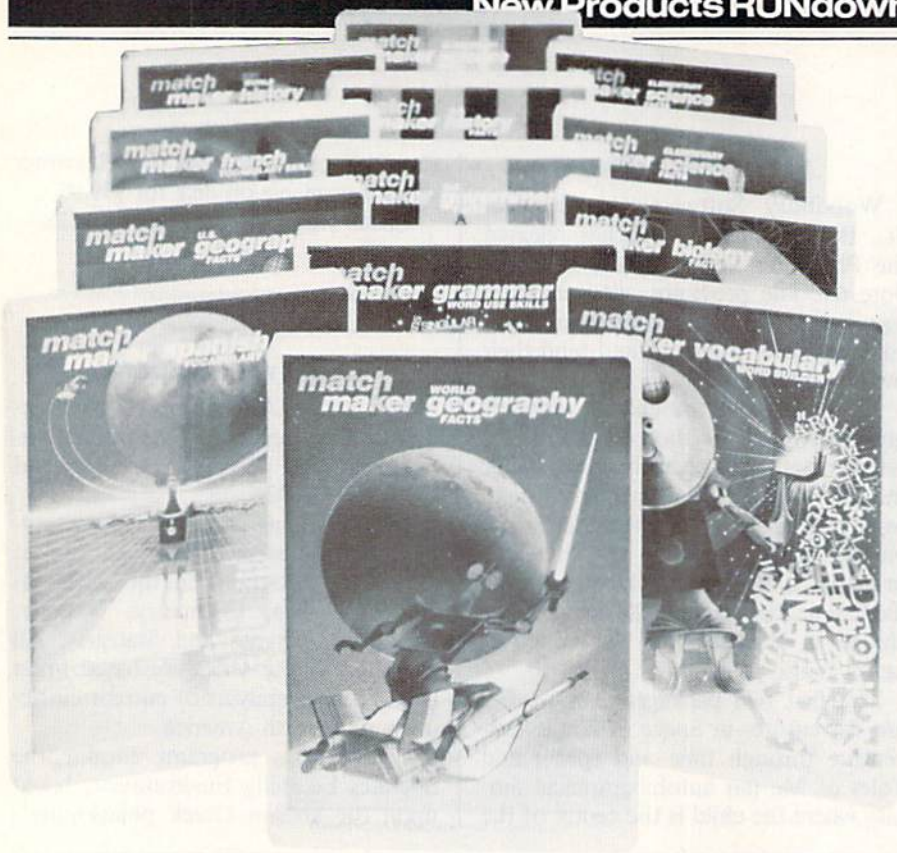

dialectical approach to acquiring knowledge. Students can interrupt, ask questions, test themselves and explore other subjects.

The Arrakis Advantage programs are available on disk for the Commodore 64 and retail for $39.95 each.

Check Reader Service number 414.

Take Control of Your Printer

Print-Eze is a printer configuration program for the Commodore 64, from JM Research (645 Paco Drive, Los Altos, CA 94022).

Print-Eze gives you access to print modes, format controls, graphics and other controls of your dot-matrix printer. It allows you to set up your printer prior to using databases, spreadsheets and other printer-supported software. Versions are available for Epson, Gemini, Okidata and Prowriter printers.

Print-Eze is available on disk or cassette for $27. A backup copy is available for $3.

Check Reader Service number 425.

New Matchmaker Software

American Educational Computer, Inc. (2450 Embarcadero Way, Palo Alto, CA 94303) has released a new generation of software programs in its Matchmaker series for the C-64.

The new programs are U.S. Government, World History, Biology, French and Science I, II and III. The programs are designed to parallel the student's classroom experience at each grade level.

All programs in the series include high-resolution graphics, color and animation. Visual rewards and games are offered to the student after successful completion of a series of questions.

The programs are available on disk and retail for $39.95 each.

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For the Home

Batteries Included (3303 Harbor Blvd., Suite C9, Costa Mesa, CA 92626) has released HomePak, a software package combining a telecommunications ter-

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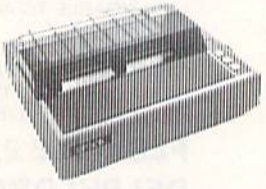

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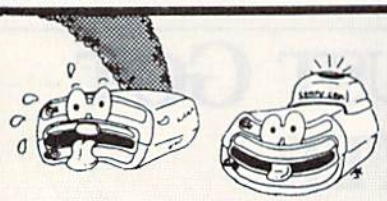

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All three programs are integrated, with vital commands constantly available through menus. The entire package is available for $49.95.

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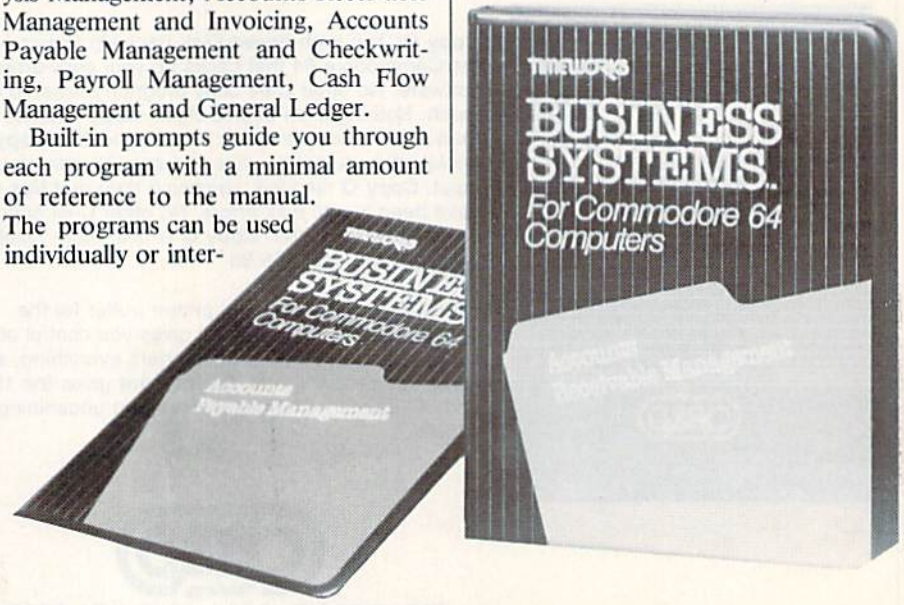
All Business

Timeworks, Inc. (444 Lake Cook Road, Deerfield, IL 60015) has developed new, expanded versions of their Business Systems software programs for the Commodore 64.

The programs available in the series are Inventory Management, Sales Analysis Management, Accounts Receivable Management and Invoicing, Accounts Payable Management and Checkwriting, Payroll Management, Cash Flow Management and General Ledger.

Built-in prompts guide you through each program with a minimal amount of reference to the manual. The programs can be used individually or interfaced with other programs in the series to form an integrated accounting system. They are available on disk for $59.95 each.

Check Reader Service number 402.



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Your Personal Net Worth is available on disk for the Commodore 64, with a retail price of $79.95. Scarborough Systems, Inc., 25 N. Broadway, Tarrytown, NY 10591.

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The Muppet Learning Keys is a computer peripheral that is designed to help children ages three and up learn letters, numbers and colors with the assistance of the Muppets.

The keyboard allows the child to bypass the potentially confusing computer keyboard. It simulates the familiar contents of a child's school desk (ruler, watercolor set, penmanship slate, compass, eraser and arithmetic exercise book) to help the child learn basic skills. There is also a comic book on the desk to provide command keys for the programs. Kermit the Frog, Miss Piggy, Gonzo and Fozzie Bear provide friendly and humorous instruction.

The desk materials are depicted on a mylar surface over a circuit board. The unit connects to a display screen through the joystick port on the Commodore 64. It retails for $79.95. Koala Technologies Corp., 3100 Patrick Henry Drive, Santa Clara, CA 95052.

Check Reader Service number 430.

Silicon Slick

Snake River Software, Inc. (2100 Belmont Ave., Idaho Falls, ID 83401) has released Silicon Slick's Lowball Draw Poker for the Commodore 64.

The program is a game, an instructor and an analysis tool for beginning to experienced card players. You can specify a variety of options to simulate the type of game in which you are most interested.

You are allowed to make your own betting decisions, and the program will supply comments on all facets of your game. You can also set up and study special situations. The program is available on disk for $34.95.

Check Reader Service number 426.

Your Finest Hour

Spitfire Ace puts you in the cockpit of a World War II fighter plane. You must maneuver your aircraft through a series of fighter tactics, including aileron rolls, loops, split Ss and Immelmann turns in your dogfight with the enemy.

Fourteen combat scenarios are featured, including the Battle of Britain. Using the characteristics of British and German fighters and bombers, the game features bailouts, channel ditching, crash landings, limited ammunition, night missions, combat flying maneuvers and four skill levels.

One to four players can compete for the distinction of being the World's Greatest Fighter Pilot. Spitfire Ace is available on disk or cassette for the Commodore 64. Retail price is $29.95. MicroProse Software, 10616 Beaver Dam Road, Hunt Valley, MD 21030.

Check Reader Service number 420.

Get Rich!

Continental Software (11223 South Hindry Ave., Los Angeles, CA 90045) has released Get Rich: Strategies, the first volume in a series of personal financial planning programs.

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fers a range of financial solutions tailored to individual needs. It gives you a profile of your entire financial picture.

The program incorporates three major financial planning tools: Worksheets allow you to set goals and determine your net worth and discretionary income; Calculations help you to solve a variety of problems involving money, time and interest, and Graphs analyze the performance of investments, interest rates and more.

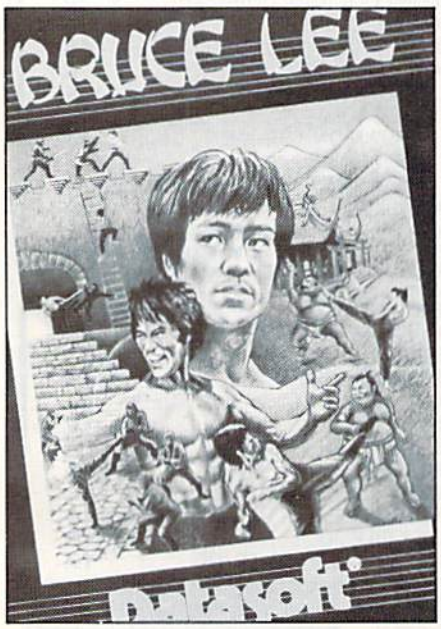
Get Rich: Strategies is available on disk for the Commodore 64. Retail price is $49.95.

Check Reader Service number 421.

Bruce Lee

Datasoft, Inc. (19808 Nordhoff Place, Chatsworth, CA 91311) has released Bruce Lee, an action/strategy game based upon the famed martial arts expert.

As Bruce Lee, you must summon all of your combative and strategic prowess to penetrate each of 20 chambers within the menacing fortress of the Evil Wizard. A hidden treasure awaits you in the fortress.



Many dangers also await you as you journey through the chambers, including the deadly Ninja and his arsenal of weapons, the massive Yamo with his stunning blows and the lethal flames that leap from the eyes of the Evil Wizard. To win the treasure, you must defeat them all.

Bruce Lee is available on disk for the Commodore 64. Retail price is $34.95.

Check Reader Service number 403.

Crazy Conveyors

In Crazy Conveyors, you must climb ladders, slide down fire poles and traverse unpredictable moving conveyors in a race against time.

To score points, you must gather ammunition, which you will need to fend off a variety of cunning creatures. The faster you can clear the screen, the more bonus points you will win.

The built-in Screen Creator allows you to modify the game screens or build entirely new ones. The game has options for one to four players.

Crazy Conveyors is available on disk for the Commodore 64. It retails for $39.95. Bytes and Bits, 524 East Canterbury Lane, Phoenix, AZ 85022.

Check Reader Service number 419.

Incredible!

Sight & Sound Music Software, Inc. (3200 South 166th St., New Berlin, WI 53151) has released the Incredible Musical Keyboard, designed to allow beginners to start playing their own music immediately.

The musical keyboard fits directly onto the Commodore 64 keyboard. It lets you create piano, guitar, synthesizer and other musical sounds with an accompanying music software program on disk. You can play melody and harmony over an eight-octave range. You can also control bass, mid-range and treble settings.

Note stickers are included for attachment to the keys. This allows beginners to play songs from the Letter Music Song Book included with the package. For experienced musicians, a Melody Chord Song Book is included, featuring hits of top contemporary recording artists. You can also play songs from your own sheet music.

The Incredible Musical Keyboard retails for $39.95.

Check Reader Service number 404.

Get Your ACT Together!

Krell Software Corp. (1320 Stony Brook Road, Stony Brook, NY 11790) has released the ACT Preparation Series, designed to help students prepare

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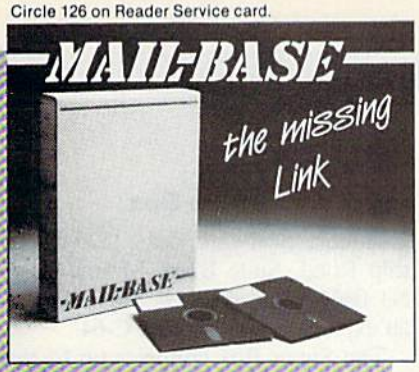

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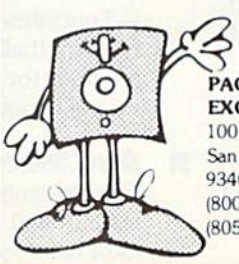

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Ocean Quest is designed for ages eight and up. It is available on disk for the Commodore 64. Retail price is $39.95. Human Engineered Software, 150 North Hill Drive, Brisbane, CA 94005.

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Super Box

Handic Software, Inc. (520 Fellowship Road, Suite B206, Mount Laurel, NJ 08054) has released Super Box 64, an expansion unit for the C-64.

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COMING NEXT MONTH

- **New Micros** The long-awaited unveiling of Commodore's two newest microcomputers has finally arrived. In the November issue, *RUN* will review Commodore's new "productivity" and game machines, the Plus 4 and the 16, respectively. Readers will get an in-depth look at these new micros, along with the support hardware and software available for these new units. The review also examines how compatible they are with existing Commodore systems.
- **Buyer's Guide** Looking for products and manufacturers that support Commodore systems? The November issue will feature a comprehensive listing of manufacturers of peripherals, including modems, memory devices, low-cost printers, disk drives, monitors and other hardware boards and cartridges that can be used with Commodores.
- **Bridging the Gap** If you've been wondering how to get your non-Commodore printer to work with your Commodore computer, don't despair. This article has the answer in the form of printer interfaces. It will explain why you need a printer interface, how it works and which ones are available for you.
- **Program of the Month** November readers will be treated to *RUN*'s regular feature—the program of the month. This month's attraction is a full-fledged database program that lets readers store, categorize and sort data with consummate ease.
- **Line Squeezer** Here's a handy utility that lets you squeeze program lines to make a program as small as possible, and usually, faster running. In addition, you save valuable memory space.
- **Lighter Side** In addition to these useful reviews, applications programs and utilities, *RUN* will feature the following game programs that you can type into your computer:

  —**Taxman** In this Pac-Man-like game for the C-64, you've got to be quick to stay ahead of that money-grubbing taxman, who's hot on your trail. He's after your every dollar.

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- **And More . . .**

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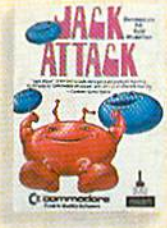

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